PB-230 753

POLLUTION OF THE INTERSTATE WATERS OF LAKE CHAMPLAIN AND ITS TRIBUTARY BASIN, NEW YORK-VERMONT. PROCEEDINGS OF CONFERENCE, SESSION (2nd) HELD AT BURLINGTON, VERMONT ON JUNE 25, 1970

Federal Water Quality Administration
Washington, D.C.

1970

DISTRIBUTED BY:

NTIS
National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

PB 230 753 ✓

PROCEEDINGS

C A N A D A
V E R M O N T
N E W Y O R K

SECOND SESSION
JUNE 25, 1970
BURLINGTON, VERMONT

CONFERENCE

Pollution of the Interstate Waters of Lake Champlain and its Tributary Basin, – New York – Vermont

U. S. DEPARTMENT OF THE INTERIOR • FEDERAL WATER QUALITY ADMINISTRATION

SECOND SESSION OF THE CONFERENCE IN THE MATTER OF POLLUTION OF THE INTERSTATE WATERS OF LAKE CHAMPLAIN AND ITS TRIBUTARY BASIN - NEW YORK - VERMONT

Ramada Inn
Burlington, Vermont
June 25, 1970

ia

CONTENTS

	Page
MURRAY STEIN	3
HON. DEANE C. DAVIS	7
DR. CHARLES S. HOUSTON	15
ROBERT GORDON AND PAUL BUTTERFIELD	16
ALBERT BROMBERG	22
ROSCOE MASTERMAN	146
WILLIAM S. COWLES, JR.	166
PETER S. PAINE, JR.	167 & 257
R. A. WILLIS	190
MRS. N. C. GARLAND	194
JOHN A. WILLIAMS	197
DONALD B. STEVENS	203
PAUL NETH	244
EDMUND MORETTE	260
EDWARD P. HAMILTON	273
JAMES J. McKEOWN	280
ALBERT PELOQUIN	327

Second Session of the Conference in the matter of Pollution of the Interstate Waters of Lake Champlain and Its Tributary Basin (New York and Vermont), held at the Ramada Inn, Burlington, Vermont, on June 25, 1970, at 9:43 a.m.

PRESIDING:

Murray Stein, Assistant Commissioner - Enforcement and Standards Compliance, Federal Water Quality Administration, U. S. Department of the Interior, Washington, D. C.

CONFEREES:

Alfred Peloquin, Executive Secretary, New England Interstate Water Pollution Control Commission, Boston, Massachusetts.

Paul Eastman, Assistant Commissioner, New York State Health Department, Albany, New York

Herbert R. Pahren, Deputy Director, FWQA, Northeast Region, Boston, Massachusetts.

Denning Miller, Chairman, Vermont Water Resources Board, Montpelier, Vermont

CONFEREES: (Continued)

John Hansen, Assistant Attorney General for Vermont.

William Albert, Director, Water Pollution Control Division, Department of Water Resources, Montpelier, Vermont.

PARTICIPANTS:

The Honorable Deane C. Davis, Governor, State of Vermont.

Dr. Charles S. Houston, Professor and Chairman, Department of Community Medicine, University of Vermont Medical School, Burlington, Vermont.

Robert Gordon and Paul Butterfield, Medical Students, University of Vermont.

Albert Bromberg, Chief of Operations, Hudson-Delaware Basins Office, Federal Water Quality Administration, Edison, New Jersey.

Roscoe Masterman, Vice President, International Paper Company, General Manager, Northern Division, Glens Falls, New York.

William S. Cowles, Jr., Vermont Chairman, Lake Champlain Committee, Shelburne, Vermont.

PARTICIPANTS: (Continued)

Peter S. Paine, Jr., General Counsel, Lake Champlain Committee, Willsboro, New York.

R. A. Willis, Executive Director, Addison County Regional Planning, Middlebury, Vermont.

Mrs. N. C. Garland, Vermont State Board, League of Women Voters, Burlington, Vermont.

John A. Williams, Co-Chairman, Mount Independence Associates, Inc., Montpelier, Vermont.

Donald B. Stevens, Director, Bureau of Water Quality Management, Division of Pure Waters, New York State Department of Health, Albany, New York.

Paul Neth, Bureau of Fish, New York State Conservation Department.

Edmund Morette, Past President-Director, New York State Conservation Council, Ticonderoga, New York.

Edward P. Hamilton, Director, Fort Ticonderoga.

James J. McKeown, Regional Engineer, National Council for Air and Stream Improvement, Tufts University, Medford, Massachusetts.

Albert Peloquin, Executive Secretary, New England Interstate Water Pollution Control Commission, Boston, Massachusetts.

ATTENDEES:

Ward I. Arnold, Assistant Director of Air and Water Management, International Paper Company, Glens Falls, New York.

Anne K. Baker, Secretary, Lake Champlain Committee, P.O. Box 5, Shelburne, Vermont.

Athan Baskous, Regional Engineer, New York State Department of Health, Albany, New York.

M. K. Baxter, Senior Scientist, Division of Ind. Science and Techn., New York State Dept. of Commerce, Albany, New York.

Larry Bender, News Supervisor, WPTZ-TV, 357 Cornelin Street, Plattsburgh, New York.

Rudolph J. Bobka, Assoc. Prof. of Chemistry, Plattsburgh State U., College, Plattsburgh, New York.

Joseph A. Brabic, Student, Plattsburgh State Univ., College, 141 Brinkerhoff, Plattsburgh, New York.

William C. Brierley, Sanitary Engineer, State of Vermont, County Road, Montpelier, Vermont.

Gregory Brown, Volunteer, Lake Champlain Committee, 125 Elmwood Avenue, Burlington, Vermont.

Paul B. Carroll, International Paper Company, 220 East 42nd Street, New York, New York.

David L. Clough, Chief, Water Quality, Vermont Department of Water Resources, State Office Building, Montpelier, Vermont.

Larry Cohen, Engineering Aide, New England Interstate Water Pollution Control Commission, 73 Tremond Street, Boston, Mass.

William S. Cowles, Jr., Vermont Chairman, Lake Champlain Committee, Shelburne, Vermont.

Dave Dillon, WJOY Radio, Burlington, Vermont.

ATTENDEES: (Continued)

Dana B. Dolloff, Air and Water Management Engineer, International Paper Company, Baldwin Road, Ticonderoga, New York.

John C. Dreimiller, Mayor, 327 Lake George Avenue, Ticonderoga, New York.

Willard B. Farnham, Industrial Waste Engineer, Vermont Department of Water Resources, State Office Building, Montpelier, Vermont.

Edward V. Fitzpatrick, Director, New England Basins Office, Federal Water Quality Administration, Needham Heights, Massachusetts.

Francis Foster, Supervisor, Washington County-N.Y.S., Chemons, New York.

Keith Fry, Assistant to the Vice President, International Paper Company, 220 East 42nd Street, New York, N.Y.

Emma-Lou Gale, Office Manager, Lake Champlain Committee, Shelburne, Vermont.

Joseph Gamele, Vermont Press Bureau, Montpelier, Vt.

Charles F. Gardephe, Conservation Bio.-Stream Protection, N.Y.S. Conservation Department, Raybrook, N.Y.

Jacob Gelberman, Chief, Operations Division, U. S. Army Corps of Engineers, 26 Federal Plaza, New York, N.Y.

Frank X. Goss, Public Relations Manager, Northern Division, International Paper Company, P.O. Box 500, Glens Falls, N.Y.

Lee Grunewald, Sanitary Engineer, Department of Water Resources, Montpelier, Vermont.

Leonard C. Halnon, Chief Fishery Biologist, Vermont Fish and Game Department, Montpelier, Vermont.

A. Hamelin, WCAX-TV, Burlington, Vermont.

ATTENDEES: (Continued)

Henry M. Holman, Sanitary Engineer, U. S. Public Health Service, Region I, Boston, Mass.

Mike Kandis, Chief Photographer, WPTL-TV, 357 Cornelia Street, Plattsburgh, N.Y.

Edwin R. Knox, Chief Engineer, Republic Steel Corporation, Adirondack Ore Mines, Port Henry, N.Y.

Jane M. Lape, Fort Ticonderoga, Box 590, Ticonderoga, New York.

Blake T. Lawrence, Lake Champlain Committee, Charlotte, Vermont.

William J. Librizzi, Chief, Inventory and Compliance Section, Hudson-Delaware Basins Office, Federal Water Quality Administration, Edison, New Jersey.

James M. MacMartin, Director, Habitat Control Division, Vermont Fish and Game Department, 151 Main Street, Montpelier, Vermont.

Pete Martin, WCAX-TV, Burlington, Vermont.

Frank Martucci, Supervisor, Washington County, 8 Mountain Street, Whitehall, N.Y.

Lawrence J. Mauriollo, Student, Plattsburgh State Inland Lakes Lab, Plattsburgh, N.Y.

James R. S. McCartney, Technical Director Regulatory Compliance, Standard Packaging Corporation, 111 Prospect Street, Stamford, Conn.

James McColl, Manager, Client Development, Roy F. Weston, Lewis Lane, W. Chester, Penn.

Fred Mehlman, Member, Vermont Water Resources Board, 52 Clarendon Avenue, Montpelier, Vermont.

Edward H. Meiser, Inspector, Harbor Supervision Branch, U.S. Army Corps of Engineers, P.O. Box 209, Lansingburgh Station, Troy, N.Y.

ATTENDEES: (Continued)

James W. Morse, Aquatic Biologist, Vermont Department of Water Resources, Richmond, Vermont.

William J. Moses, Attorney-Advisor, Office of Residual Solicitor, U.S. Dept. of the Interior, 420 Chestnut Street, Philadelphia, Penn.

Gareth Ott, Project Engineer, Martin Marietta Corporation, Denver and Albany, Albany, N.Y.

Irwin L. Paradis, Assistant Health Officer, Vermont State Health Department, Colchester Avenue, Burlington, Vt.

Stu Perry, Burlington Free Press, 278 College Street, Burlington, Vermont.

Milton Potash, Professor of Zoology, Univ. of Vermont, Burlington, Vermont.

John V. Richards, Associate, Weston & Sampson, 10 High Street, Boston, Mass.

Mrs. Bronwyn Rider, Chairman, Environmental Quality Committee, Burlington League of Women Voters, 56 Sky Drive, Burlington, Vermont.

Benjamin P. Robinson, Chief, Engineering Branch, 27 Federal Plaza, New York, N.Y.

Betsy Samuelson, United Press, Montpelier, Vermont.

Irene Shen, Student, S.U.M.Y., Plattsburgh, N.Y.

Ronald R. Sitler, BMC, OINC, Burlington L.A.S., U.S. Coast Guard, Box 533, U.S. Coast Guard, Burlington, Vt.

S. R. Southworth, Reporter, Press-Republican, Clinton Street, Plattsburgh, N.Y.

Mary Spargo, Senior Public Information Specialist, Division of Pure Waters, New York State Health Department, 84 Holland Avenue, Albany, N.Y.

Lois Steele, Lake Champlain Committee, Shelburne, Vt.

ATTENDEES: (Continued)

Richard Valentinetti, Air Pollution Control, State of Vermont, Box 607,Barre, Vermont.

Kenneth H. Walker, Director, Hudson-Delaware Basins Office, Federal Water Quality Administration, Edison, N.J.

Robert B. Williams, Secretary, Vermont Agency of Environmental Conservation, State House, Montpelier, Vermont.

R. A. Willis, Executive Director, Addison County Regional Planning, Middlebury, Vermont.

John Zamit, Chief, River and Harbor Section, U.S. Corps of Engineers, 26 Federal Plaza, New York, N.Y.

PROCEEDINGS

MR. STEIN: The conference is open.

This is the second session reconvened of the Conference on Pollution of the Interstate Waters of Lake Champlain and its Tributary Basin. Sessions of the conference were held November 13 and December 19 and 20, 1968. This was initiated on the basis of a written request to the Secretary of the Interior from the Vermont Department of Water Resources, dated August 12, 1968, as well as on the basis of reports, surveys and studies.

The conference was held in Burlington, Vermont, on November 13, recessed and reconvened in executive session December 19 and 20, 1968.

The conference came to various conclusions and recommendations at the first session, and they came to these unanimously. I will just go over some of these to establish the jurisdiction of the conference. The recommendations and conclusions in part are as follows:

The water of Lake Champlain, from the Champlain Canal in the south to the Canadian border to the north, and that portion of its tributary basin which affects the lake, received the discharge of treated and untreated wastes from industries, municipalities, a Federal installation, individual septic tanks and cesspools, recreational and commercial boating, and agricultural and land drainage.

As a result of these discharges, portions of the interstate waters of Lake Champlain and its tributaries are degraded below the classifications established by the States and approved by the Secretary of the Interior by the presence of bacteria, solids, oxygen-demanding material, and nutrients.

In addition, some of these waters are affected by the accumulation of bottom sludge deposits and floating sludge masses. This pollution limits the use of these waters for such activities as recreational bathing, boating, and general esthetic enjoyment. Bacterial contamination, in particular, presents a health hazard to persons using these waters.

Pollution of the interstate waters subject to abatement under Section 10 of the Federal Water Pollution Control Act, as amended, occurs in Lake Champlain:

1. In the vicinity of Ticonderoga Bay and on Lake Champlain from Chipmans Point to Larrobees Point, as the result of the discharge of untreated waste from the Village of Ticonderoga and from the International Paper Company plant.

2. Near Whitehall, as the result of the discharge of raw sewage from the Village of Whitehall; and in the Poultney River Basin as a result of slate processing operations in Vermont and New York, and treated and untreated

wastes from the Village of Poultney, Vermont, and Granville, New York.

As the result of untreated industrial waste discharges, several areas of Lake Champlain contain extensive sludge deposits. The major deposits affecting the waters of Vermont are near the mouth of Ticonderoga Creek and are due mainly to the discharge of untreated paper mill wastes from the International Paper Company.

And the rest of the conclusions and recommendations deal with procedures and methods for cleaning this up. But I think this will give you the notion of at least the general area concerned and the statement of the facts agreed on by the two States and the Federal Government.

At this session of the conference, we hope to evaluate what progress has been made and take a very careful look at what still needs to be done, if anything, and set up a procedure for accomplishing this.

The conferees represent the New England Interstate Commission, the State of New York, the State of Vermont, and the Federal Government. And in a few moments, we will have the conferees introduce themselves.

The procedure in the conference will be for us to call on the Federal Government and both States to make statements and for the States and the Federal Government to call any invitees to make statements. Anyone wishing to make a statement should register with the particular State that that person comes from or lives in. And if you wish, the law provides that you can come to the chairman, and I will put you on.

After each statement we will permit the conferees to make comments or ask questions. I would ask the people in the audience to confine their questions or comments to the time they are making a statement, because we will not take questions or comments from the floor.

I would suggest that anyone other than the conferees come to the podium to make his statement and identify himself for the purpose of the record.

A transcript and summary of the conference will be made available to your State agency, and that generally takes about 3 or 4 months. So if you want a transcript earlier, you can get in touch with the court reporter who is an independent contractor and make your own arrangements.

First I think before we get into the conference, it is indeed our privilege today to have with us and call on Governor Deane C. Davis of Vermont.

Governor Davis.

(Standing applause.)

STATEMENT OF
THE HONORABLE DEANE C. DAVIS
GOVERNOR, STATE OF VERMONT

GOVERNOR DAVIS: Mr. Chairman and members of the conference, I would like the record to show what is already existing in fact -- that representing the State of Vermont as conferees will be Mr. Denning Miller who has served for some years as chairman of the Water Resources Board; Mr. John Hansen, who is an attorney in the Office of the Attorney General; Mr. William Albert, who has for some years had the primary responsibility for water quality as an officer of the Water Resources Department.

My name is Deane Davis, as the chairman has said. And I have a formal statement to make, Mr. Chairman.

It is indeed a pleasure for us to welcome the conferees and participants in this vitally important conference regarding the pollution of the interstate waters of Lake Champlain and its tributary basin. I am particularly happy that the conference has been reconvened here in Burlington.

The panoramic beauty of Lake Champlain and its surrounding mountains when viewed from this, our largest city, may in some measure explain the pride which all Vermonters feel towards this natural scenic wonder. Aside from its significance to Vermont, the lake is one of the largest remaining relatively clear lakes in the United States, as unclear as it may turn out to be. Its location in relation to the megalopolis to the south of us makes this lake and its future significant not only for Vermont and New York but for most of the northeast region as well. Thus, what happens to Lake Champlain is truly of interstate concern.

I believe I speak for every single Vermonter when I say that we are concerned, upset and even somewhat embittered about what has occurred to the water quality in that area of the lake adjacent to Ticonderoga, New York (a place by the way of no small significance in Vermont Revolutionary history).

As the record in these proceedings clearly discloses, that area of this otherwise beautiful lake is infested with massive sludge deposits originating from industrial operations in that New York community. These sludge deposits, which have been added to daily in the 680-plus days since Vermont requested this conference, have so deteriorated water quality in this area that not only is the water far below the standards established by both New York and Vermont, it is indeed well below any recognized water use class.

In the face of this problem, Vermont is virtually powerless to act. By standards which have been accepted and approved by the Secretary of the Interior, we are obliged to obtain and maintain a "B" water quality in the Vermont waters adjacent to those sludge deposits. Yet, this water quality goal is impossible of attainment so long as these polluting deposits remain unchecked in the waters of the lake.

No treatment facility which we might construct and no order which we might issue here in Vermont, one which we might enforce, will enable this State to solve this pollution problem on a unilateral basis. Under these circumstances, we have recognized the intent of Congress as expressed in the Federal Water Pollution Control Act and have now placed our faith in the conference method as the only available means to abate this pollution problem.

Once again speaking, I believe, for every single Vermonter, I submit that the true value of our patience and faith in this Federal proceeding and indeed in this particular concept of water pollution control federalism will be determined by the outcome of this reconvened conference.

As I am sure everyone here realizes, these proceedings were initiated by a request from the State of Vermont in August 1968 for a conference to study and abate pollution of the waters of Vermont by wastes discharged into Ticonderoga Bay of Lake Champlain from the pulp and paper industry situated on Ticonderoga Creek in the vicinity of Ticonderoga, New York.

Although the scope of the conference was broadened before it started to include all of Lake Champlain and its tributary basin, there is ample basis to find in the record of the proceedings on November 13, 1968, and the executive session on December 19, 20, 1968, that with respect to the Vermont waters adjacent to Ticonderoga Bay:

1. Pollution has occurred which is subject to abatement under this Federal Act.

2. No effective progress has been made to abate this particular pollution problem.

3. The health and welfare of persons has been and is endangered by this pollution.

The evidence presented by the Vermont Water Resources Department as supplemented by data of other State, regional and Federal agencies clearly establishes the poor water quality and use impairment in this area of interstate waters. Furthermore, in our opinion, the evidence is unequivocal that this pollution has and continues to emanate from the pulp and paper industry now operated by International Paper Company in Ticonderoga, New York.

Our conclusions in all of these respects seem to be supported by the summary of the conference issued by the conferees following the 1968 proceedings, which summary was incorporated into the recommendations issued by the acting Secretary of the Interior in 1969. Yet, we note with some concern that there has yet to appear any specific recommendation from either the conferees or the Secretary dealing with abatement of the condition for which Vermont originally requested the conference.

We note with even greater concern that during the time it took to complete the recommended sludge removal feasibility study, no visible efforts have been made by the State of New York or the Secretary to regulate even on a remedial basis the continued discharge of wastes resulting in even greater sludge deposit accumulation.

Under these circumstances we fervently hope that the attention of this reconvened conference will be directed to this particular pollution problem, if necessary, to the exclusion of all other matters, for we, as Vermonters, as Americans, can no longer remain passive to this flagrant abuse of water.

Mr. Chairman, I realize the purpose and possible benefits of the conference technique and that our complaints are meaningless unless backed up by positive recommendations. It is now well established that a pollution problem subject to abatement does in fact exist, namely, the sludge deposits in and adjacent to Ticonderoga Bay. It should be well established by reports submitted today by the Corps of Engineers, the technical committee and Federal authorities that this pollution problem can be abated feasibly.

The only logical remaining step to take is a recommendation that the specific problem be abated. Therefore, the State of Vermont respectfully requests that:

1. The conferees recommend to the Secretary that he issue an immediate recommendation to the State of New York to take appropriate action to secure removal of all these sludge deposits in this area of Lake Champlain.

2. The conferees recommend to the Secretary that he issue an immediate recommendation to the State of New York requesting appropriate action to regulate and control the effluent discharged from the present International Paper Company plant into Ticonderoga Creek with the intent of preventing further accumulations of sludge and pollution in Lake Champlain.

With reference to our first request, the studies made to date indicate that the only effective method is the removal of the sludge deposits. We believe that through the proper use of modern technology the sludge can be removed without detrimentally affecting the rest of the lake and that any unavoidable problems will be temporary in nature and will be dramatically less than the problems caused by leaving the sludge in the water. We request immediate action in this respect due to the obvious delays that will be encountered in Federal enforcement procedures should the conference technique prove unavailing.

In regard to our second request, we wish to point out that the need for effluent control measures at the paper plant seems to have been repeatedly overlooked because of the prospect of the new paper plant opening north of Ticonderoga. The instant problem is sludge in Lake Champlain and logic alone dictates that if not before, at least now some control measures should be instituted to prevent further sludge accumulations. We see no logic in the idea that the anticipated opening of the new plant justifies lack of adequate treatment in the old plant during the phasing out period.

In conclusion, Mr. Chairman, past experience in other large lakes has demonstrated the folly of procrastination where the laws of nature are involved. Once lake eutrophication begins, it is as you so well know virtually impossible to arrest the process and the resulting penalty of this law of nature is a tragic loss to us all.

And I might add just a word, Mr. Chairman, and members of the conference, we do not wish to appear in the State of Vermont unreasonably belligerent about this matter, but we do think the long time that has taken place demands perhaps a little more than the usual speed in dealing with the problem. We pledge on behalf of Vermont a cooperative attitude of all those concerned with this problem in New York, the International Paper Company or anybody else, all the Federal and

State agencies that are involved. But our people in Vermont really are entitled to some action that is meaningful.

And, Mr. Chairman, with your permission, I would like to introduce three gentlemen here who purely coincidentally -- and this seems a little hard to believe, but it is true -- have taken some samples of these waters just within the last 24 or 48 hours or so that I think are truly dramatic and make it possible for us to see what we are talking about here in a way that makes it so much more meaningful. And these are two medical students at the University of Vermont who are working on a project during the summer under the supervision of Dr. Charles Houston of the Medical School.

I will introduce Dr. Charles Houston with your permission, if this is allowable --

MR. STEIN: Yes, certainly.

GOVERNOR DAVIS: -- and ask him to come to the microphone and introduce the two students and show these exhibits.

Thank you very much, Mr. Chairman.

(Applause.)

STATEMENT OF
DR. CHARLES S. HOUSTON
PROFESSOR AND CHAIRMAN
DEPARTMENT OF COMMUNITY MEDICINE
UNIVERSITY OF VERMONT MEDICAL SCHOOL

DR. HOUSTON: My name is Charles Houston. I am professor and chairman of the Department of Community Medicine at the University of Vermont Medical College.

I have no formal statement to make because this is, indeed, a coincidence.

I formerly served on the Federal Water Pollution Control Advisory Board which is part of my interest of the waters of the lake.

The Department of Community Medicine has 10 summer fellowships which enable medical students to work on community problems throughout the State. Five students this summer are working on problems of pollution in cooperation with the Lake Champlain Research Study Center and the Lake Champlain committee chairman, Mr. Cowles, and with the State Water Resources Board.

Two of the students are particularly interested in waters around Shelburne Bay, Queen City Park, which is immediately adjacent to a very beautiful tract of land recently acquired by South Burlington. Their interest extends to all types of pollutants in that water. And as part of their project, they have planned for some time to investigate the effluent from the Ticonderoga Creek area which is borne northward through the lake.

Because of postponement for one reason or another, they were not able to do this project until yesterday. Borrowing a boat, they went up Ticonderoga Creek, took a number of samples under the direction of Lake Champlain Study Research Center's Dr. Potash and Dr. Hansen and brought these samples back last night.

It was then for the first time that they learned about this conference. And it seemed an opportunity that was too good for us to miss. So it is a pleasure and it is a coincidence that I introduce Paul Butterfield and Bob Gordon, second year medical students at the University of Vermont, who will speak from here.

MR. STEIN: Introduce yourselves for purposes of the record so the reporter knows which is which.

STATEMENT OF
ROBERT GORDON AND PAUL BUTTERFIELD
MEDICAL STUDENTS, UNIVERSITY OF VERMONT

MR. GORDON: I am Robert Gordon, and this is Paul

Butterfield.

Our basic purpose in going to Ticonderoga was originally to sample water for mercury. The plant a few weeks ago was closed down, and we want to sample the water before and after -- that is, once the plant started operating again -- to see if there was a difference in the level. Unfortunately, when we got to Ticonderoga Creek, the plant was already operating again.

However, this did not prevent us from taking water samples. We took some samples.

This is hard for most of you to see, but I will explain. We took some water samples at the north of the mouth of the creek which runs right here (demonstrating on map) and we took it north of the creek -- water flows south to north -- to see what we could get for samples.

We took samples north of the creek up here, and Paul has a sample of that.

The next place we took, we went where the sludge deposits were at the beginning of the mouth of the creek. And we got stuck. Our boat completely got stuck in the sludge. We were just bombing through, and we stuck a paddle down after we got stuck and saw we were only about two feet from the surface. Unfortunately, it was hard to tell because the water was so dark. We didn't realize the extent of the problem.

And we also took some bottom sediments of what we found, what the sludge actually is like.

The next thing that we did was take some water samples where we were at the sludge deposits. And to say the least, the air was very bad. And I think if you smell the water -- you can pass it around -- you get an idea what it was like down there.

The next thing that we did was to go above the plant. We were out over here. We took a water sample above the plant to see what the condition of the water was before it reached the plant.

Paul has a sample of that. It is quite clear, very good looking. We haven't tested this for chemical analysis yet.

The next thing we did was go beyond the plant, shortly beyond the plant, and took a water sample to see what the water was like after it had gone through the plant and waste had been dumped into it. That is down here somewhere. The plant was up here.

That is basically what we did yesterday. To say the least, we were very shocked and disappointed to see the extent of the problem. The air is very bad smelling. And if you smell the water, you will get an idea what it is like.

Do you have any other comments, Paul?

MR. BUTTERFIELD: No.

MR. STEIN: Thank you very much.

I guess this is a longstanding problem.

In looking at these boys, you know, when I was about your age in the '30's, I started at Lake George and took a canoe trip up to Ticonderoga. I was always interested in Ticonderoga and reading about it. And when I got up there and saw what was there, I was, to put it mildly, slightly disappointed.

But I would like to point out, though, and I think the Governor's statement has been a very perceptive and analytical one, we do have requirements. And I don't want anyone to have the impression that we do not. And both the States and the Federal Government have agreed to it in the last session of the conference. And that is:

"All wastes discharged to the waters of the Lake Champlain Basin shall receive treatment adequate to insure water quality consistent with the water uses established. All waste treatment facilities discharging into the waters of Lake Champlain shall be designed to provide for substantially complete removal of all floatable and settleable material, a minimum removal of 85 percent of BOD, and suspended solids based on average design flow."

And that means any industry or any municipality or anyone else discharging not in accordance with this requirement is violating the requirement and subject to action under certainly the Federal law and I suspect under State law.

Then it says:

"Dissolved oxygen shall not be less than 5.0 mg/l at the State line at any time."

And if any discharge from the municipality or industry causes that to go below 5 mg/l at any time, or their accumulated deposits which cause that to go below that, that is also a violation and can be proceeded against accordingly.

So I do think that the requirements were set.

By the way, there are also requirements that because of the nature of the water, all effluent be disinfected to where there are no pathogens present so there is no health hazard to the lake because of its recreational use. And this would largely apply to municipalities, I suspect, in this area.

Now, our purpose here, I think, is to be able to determine whether these requirements are being met, or whether there are conditions in the lake, such as you specifically point out the sludge deposits or discharges into the lake, which cause these requirements to be violated. And if they are, we will have to determine what we are going to do about it.

Now, I would like to get on. And I was going to hold this, but maybe we had better go through this procedure so we can all identify ourselves. I wonder if the conferees would introduce themselves, starting on my left, Mr. Peloquin.

MR. PELOQUIN: I am Albert Peloquin, Executive Secretary of the New England Interstate Water Pollution Control Commission.

MR. EASTMAN: I am Paul Eastman, Assistant Commissioner of the New York State Department of Health and Director of the Division of Pure Waters.

MR. STEIN: Just start again here.

MR. ALBERT: My name is William Albert. I am Director of Water Supply and Pollution Control in the Department of Water Resources, State of Vermont.

MR. HANSEN: I am John Hansen, Assistant Attorney General, State of Vermont.

MR. MILLER: I am Denning Miller, Chairman of the Water Resources Board of the State of Vermont.

MR. PAHREN: I am Herbert Pahren, Deputy Director of the Northeast Region, Federal Water Quality Administration.

MR. STEIN: My name is Murray Stein. I am the Chief Enforcement Officer of the Federal Water Pollution Control Program in the Department of the Interior and representative of the Secretary of the Interior, Walter J. Hickel.

At this point, we would like to call on Mr. Pahren for the Federal statement.

Mr. Pahren.

MR. PAHREN: Thank you, Mr. Stein.

Mr. Albert Bromberg will present the Federal statement.

STATEMENT OF
ALBERT BROMBERG, CHIEF OF OPERATIONS
HUDSON-DELAWARE BASINS OFFICE
FEDERAL WATER QUALITY ADMINISTRATION
EDISON, NEW JERSEY

MR. BROMBERG: Mr. Chairman, conferees, my name is Bromberg. I am Chief of the Operations Branch at the Hudson-Delaware Basins Office of the Federal Water Quality Administration at Edison, New Jersey.

At the first session of this conference, held on November and December 1968, the conferees recommended that, and I quote:

"The U. S. Department of the Interior in cooperation with the New York and Vermont water pollution control authorities and the New England Interstate Water Pollution Control Commission shall carry out studies in the vicinity of Ticonderoga Bay to be completed by September 1, 1969, to determine the extent of sludge deposits, the method of correction, the ultimate disposition of the sludge, and the estimated cost of correction," and ..."A technical committee of water pollution control representatives from the Federal Water Pollution Control Administration, New York, Vermont and New England Interstate Water Pollution Control Commission is to be established...."

In conjunction with this first recommendation, a two-part study has been carried out. First, the U.S. Army Corps of Engineers, New York District, was retained to carry out a study of the sludge deposits in Ticonderoga Bay to determine the areal extent of those deposits, depth of deposits, characteristics of the deposits versus depth, volume of sludge present and alternative methods for removal and disposal with their associated costs.

Second, portions of the sludge samples collected during the Corps study were provided to FWQA for analysis. The purpose of this analysis was to determine the degree to which the deposits are polluted and the probable source of the deposits.

Results of the analyses conducted by the FWQA are contained in a report entitled "Ticonderoga Creek and Ticonderoga Bay Report," October 1969.

Mr. Chairman, I would like to ask that this report be introduced into the record as if read.

MR. STEIN: Do you have a copy of that report with you?

MR. BROMBERG: I have a copy over here, yes.

MR. STEIN: Let me look at it to evaluate it and see how big it is.

This is a copy, isn't it? I think I have one.

That will be introduced into the record as if read without objection.

(The above-mentioned report follows.)

TICONDEROGA CREEK
and
TICONDEROGA BAY
REPORT

OCTOBER, 1969

TABLE OF CONTENTS

Page

SUMMARY.. 1

INTRODUCTION... 2

METHODS.. 9

FIELD PROCEDURES... 9

CHEMICAL METHODS... 11

DATA... 13

TICONDEROGA CREEK.. 13

TICONDEROGA BAY.. 20

VERMONT SHORE.. 25

CONCLUSIONS.. 27

RECOMMENDATIONS.. 28

TABLE I

TABLE II

FIGURES 1 - 8

APPENDED NEBO REPORT

SUMMARY

Ticonderoga Creek sediments and Ticonderoga Bay sediments are polluted. The majority of this pollution is directly attributed to fly ash and cellulosic material. The fly ash material implicates the International Paper Company installations located on Ticonderoga Creek.

The majority of polluted Ticonderoga Bay sediments are found north and westerly of a line drawn between Stations 20 and 52 (Figures 4,5, and 6).

In most instances, the depth of the chemically proven pollution exceeds five feet. The geographic extent of this pollution exceeded the outer limits of this survey.

INTRODUCTION

The prime objective of this study was to establish a chemical basis for the determination as to whether or not Ticonderoga Creek and Ticonderoga Bay sediments were polluted.

Assuming that chemical pollution could be established, it was the secondary objective of this report to delineate deposits of polluted sediment, indicate to a first approximation the total polluted sediment volume and indicate the most probable major contributing source to each polluted sediment deposit; i.e. "what is it, where is it, and where did it come from."

Ticonderoga Creek arises out of Lake George and flows into Ticonderoga

Introduction (Cont.)

Bay, Lake Champlain, a distance of approximately three miles. Historically there have been small sawmills along the creek, in addition to the Village of Ticonderoga and the Ticonderoga Division of the International Paper Company. Thus any sediment pollution study, to be valid, must consider historical contributors as well as current possible pollution contributors.

For the purpose of this report, the International Paper Company complex is broken up into three main components:

1. The paper mill; comprising all paper making and fiber recovery operations.
2. The pulp mill; comprising debarking and wood chipping operations; Kraft pulping; all Kraft liquor operations; and all pulp bleaching and related operations.
3. The power generating plant; comprising all operations relating to the combustion and boiler processes.

The village of Ticonderoga surrounds the International Paper Mill. The sanitary sewers of the Town in some instances empty directly into the Creek, in other instances Town sewers empty into mill sewers, which then empty into the creek.

Three chemical parameters, Carbon, Nitrogen, and Titanium, will serve to characterize sediment pollution in this study.

Introduction (Cont.)

In order to evaluate these parameters, normal background values must be obtained. Since Ticonderoga Creek flows into Ticonderoga Bay it is logical to assume that sedimentation in the Bay is predominately influenced by sediments carried by the creek.

This sedimentation assumption is substantiated by the fact that as Ticonderoga Creek enters Ticonderoga Bay it has formed two peninsulas, one on either side of the channel.

Therefore, sediments from the Lake George headwaters of Ticonderoga Creek were used to establish chemical values of the normal sediment.

Hence, pollution is defined in this report in terms of the chemical background values found in natural sediments located at the headwaters of Ticonderoga Creek.

As previously stated, carbon is one of the chemical parameters chosen to characterize the sediments. Carbon is an indication of organic material. A general enrichment of the carbon in the sediment, in excess of the carbon found in the background material, would indicate a sediment pollution load.

Nitrogen was used as a more specific pollution indicator, to distinguish between sewage and celluslosic materials. Both sewage and celluslosic materials contain large percentages of carbon. Conversely, sewage contains large amounts of nitrogenous materials, wood does not. Only when

Introduction (Cont.)

actively growing does wood contain nitrogenous amino acids. Natural paper fibers contain little or no nitrogen. Also, the lignin portion of wood, is virtually free of nitrogen.(1)

There are no insoluble nitrogenous by-products generated by the paper making, pulping or power generation processes of the International Paper Company.

Thus, a nitrogen load in the sediment, in excess of background nitrogen values would indicate pollution by sewage.

Titanium was used as a specific indicator for the sediment pollutants contributed by the International Paper Company. Titanium can be expected to be generated at two sources within the International complex; the paper mill and the power generating plant.

The rational of titanium as a specific indicator of pollution by the Ticonderoga Paper Company is as follows:

> Considering the grades of paper made at Ticonderoga Papermill, there can be expected three main sediment pollutants from the paper mill:
>
> 1. celluslose pulp fiber
> 2. clay coating or filler materials
> 3. titanium dioxide
>
> After aging in a water environment, there is no way to distinguish the source of any particular cellulose fiber; i.e., a bleached Kraft

fiber would give the same chemical reactions as a natural cellulosic fiber.

A similar situation exists with respect to a comparison between natural clay and coating clay or clay or clay filler materials. There is no chemical way to distinguish the processed clay from the natural clays. It should also be noted that a large, natural,clay bed is known to exist upstream of the International Paper Company operations. This clay bed does add turbidity to the stream during periods of high runoff or flood flow.

However, an increased titanium load, above that of the normal background material, would be very indicative of pollution by the International Paper Company. Their paper making process uses large amounts of titanium dioxide to opacify and whiten paper. Although every effort is made to retain titanium dioxide, some is always lost in the "waste white water" of any mill. Titanium dioxide costs approximately $550/ton. The Ticonderoga Mill undoubtedly has the exact figures on the yearly tonnage of TiO_2 lost. This lost TiO_2 lost figure is a routine and important quality control figure for all paper mills using titanium dioxide.

In addition to the paper mill, titanium sediment enrichment can come from fly ash or cinders generated by the power plant. Fly ash contain approximately 0.6g of Ti/100g of fly ash, i. e., 0.6%.(2)

Introduction (Cont.)

It should be noted that saw mills inevitably burn slab waste wood for power generation, not coal. Therefore, cinder and fly ash materials cannot be ascribed to historical saw mill operations.

No significant amounts of titanium enter the sediment pollution sequence from sewage.

Therefore, Titanium pollution is ascribable only to the International Paper Company complex.

A remote possibility does exist that the townspeople themselves, could dump cinders or fly ash into the stream. However, the International power generating plant burns 130 tons of coal/day, averaging 8% to 9% ash. This consumption has been relatively stabile over the last five years. (Records were not available to us prior to 1964.) This daily consumption is based on mill operation of fifty-two weeks a year, seven days a week.(3) It is doubtful that the village generation of ash approximates that of the mill.

In summary, the carbon loading of the sediment is a general indicator of the pollution load; the nitrogen content of the sediment is an indicator of the sewage pollution load; and, the titanium loading of the sediment is an indicator of the pollution load due to the International Paper Company complex, on the Ticonderoga Creek.

If the assumption is made that historical sawmills, which are no longer in operation, contributed significantly to the sediment pollution load, then it is not justifiable to ascribe all celluslosic loading to the Town or to the International Paper Company. Of course the converse is equally true; i.e., it is not proper to blame historical, but defunct sawmills for pollution loads generated by current contributors.

A method has been devised for attributing relative sediment enrichment loads to all sources, historical and contemporary.

Titanium loading of the sediment, at the lowest sampling depth common to all sediments, determines whether or not the International Paper Company has contributed to the pollution load at that depth and above.

It also follows from the preceeding discussion that the relative magnitude of the titanium load, in excess of the background levels, describes the degree of the total pollution load for which the International Paper Company is primarily responsible.

An identical syllogism applies to the determination of nitrogen and the contribution of sewage to the pollution load. However, there is one factor that is present with respect to nitrogen that is not present with titanium; growing plants do contain nitrogen via various amino acids.

Thus buried, nondegraded, aquatic plants could add a nitrogen load to the sediment. This natural nitrogen load above normal background values, would appear in this study as a sewage pollutant.

The probability of this sort of occurrance is minimized, but not entirely negated by the selection for analysis of a relatively deep sample depth as used in the Ticonderoga Bay Study. All Bay chemical analysis, except in a very few instances which are specifically noted, were performed on samples from the 4.5 - 5.5 foot depth. At this depth, unless there had been extremely rapid sedimentation, the time lapse between burial and sampling would have been of sufficient magnitude so as to insure solubilization of the nitrogenous material in the plants. This nitrogenous plant portion is relatively unstable as compared to the lignin and celluslosic portion of the plant.

As was previously pointed out, neither the pulp mill nor the power plant processes will generate appreciable solid nitrogenous wastes.

It should be noted in this portion of the report, the remote possibility that the International Paper Company power generator plant could contribute to the carbon loading of the stream. Assuming very inefficient burning of the coal, with attendant insufficient oxygen within the combustion chamber of the boilers, the resultant ash, if dumped into the creek, would exhibit a chemical oxygen demand. This demand would be interpreted in this report as an organic carbon loading. This is justifiable interpretation since the unburnt carbon will exert a very high chemical oxygen demand. However, it is doubtful that any paper company could long remain competative on the open market, while assuming the tremendous cost of inefficiently generated power. Therefore, it is reasoned that

Introduction (Cont.)

the International Paper Company power plant will not have contributed appreciably to the over-all carbon loading of the sediments.

METHODS

Field Procedures

The sampling instruments and procedures used in this survey were devised and executed by the U.S. Army Corps of Engineers.

A separate report will be issued by the Corps of Engineers detailing exact station locations, sampling procedures, depth of sediment below the surface of the water, and other pertinent information.

However, for the purpose of correlating the chemical data in this report with the forthcoming COE report, this report will use the station numbers assigned by the Corp to identify stations. The maps used in this report, showing station identification and location were supplied by the Corp of Engineers.

The sampling grid for the Ticonderoga Bay portion of this survey was laid out by the U.S. Army Corps of Engineers with the assistance of Federal Water Pollution Control Administration personnel. Since it was not known, at the time of the survey, the direction or extent of pollution along the bottom, the survey stations were laid out along a radial grid with an apex at the Railroad Bridge across the mouth of Ticonderoga Creek. This grid layout, although appearing very comprehensive at the time, is now considered to be too conservative.

Bay sediment samples were taken by a coring device at two foot intervals starting at the top of the sediment bed. The coring device was a hollow metal tube with movable windows set and compartmentalized two feet apart. The device was driven into the sediment to the desired depth with the windows closed. The windows were then opened, and the entire corer rotated 360°. As the corer rotated, fins attached to the corer forced sediment in thru the open window and into the two compartments. The windows were then closed and the corer withdrawn.

At the surface, the windows were again opened and each sediment compartment was spooned out into a plastic bag. As the sediment was spooned out it was examined by COE personnel for odor, color, stratification and obvious composition, texture and plasicity.

Once bagged, the sediments were frozen and shipped to the New England Basins Office Laboratory for a detailed microscopic and chemical evaluation.

Sampling at any station continued at two foot intervals until it appeared, by visual inspection, that the sediment brought up was natural in origin or, the coring device could not be driven any further into the sediment.

Field Procedures (Cont.)

A similar field procedure was followed for sediment samples taken from Ticonderoga Creek.

A more detailed description of the sampling device, actual field observations and precise station coordinates can be found in the forthcoming Corp of Engineers report.

Chemical Methods

All tests involving sediments were done on an oven dry (O.D.) basis; i.e., the sediments were dried under vacuum at 50°±2°C until constant weight was achieved.

All analysis are reported in grams/100grams of sediment (O.D.). These units are directly interchangable with percent by oven dry weight.

Carbon in the Sediments

These values were calculated from results of the Chemical Oxygen Demand Test.(4) The assumption was made that all of the chemical oxygen demand of the sediments is generated by organic material. This assumption is reasonable and has precedent in the characterization of benthic sediments of the St. Croix River done by Dwight Ballinger, FWPCA Laboratory, Cincinnati, Ohio.

Organic Nitrogen in Sediments

The Organic Nitrogen was determined by a modification of the Kjeldahl

Organic Nitrogen in Sediments (Cont.)

Method as described in the Interim FWPCA Method Manual.(5) The modification of the Kjeldahl Method consisted of using two grams of oven dried sediment suspended in 400 mls. of nitrogen free water.

Titanium in Sediments

There is no standard FWPCA Method for measuring titanium in sediment. Each sediment sample for titanium analysis was extracted twice in accordance with the Official Standard Method (T 439-60), given by the Technical Association of the Pulp and Paper Industry (TAPPI).

It should be noted that the Official TAPPI Method calls for one extraction. However, the sediments were extracted twice to insure complete titanium extraction. Initially sediment samples were extracted three times, in every such instance there was no measurable titanium in the third extraction.

The amount of titanium in the extract was determined with a Perkin-Elmer Model 303 Atomic Absorption Spectrophotometer. Standard conditions for titanium, recommended by the Perkin-Elmer Methods Manual, (6) were used on the spectrophotometer.

Microscopic Method(7)

Microscopic analysis was performed by first thoroughly mixing each

Microscopic Method (Cont.)

fraction of the sediment, then removing an aliquot portion to a Petri dish. Microscopic analysis under 100X magnification proved to be sufficient to recognize all major components, i. e., bark, fiber, fly ash, silt, and decaying vegetative matter of the sediment.

By this method an estimate of the percent composition of various components was made. Deposition of unnatural materials in the study area included fly ash (or cinders), cellulose fibers, wood chips, and strips of bark.

DATA - See Tables 1 and 2, Figures 1 through 8.

The background sample for chemical and microscopic analysis was taken from sediments occurring near the exit of Lake George waters into Ticonderoga Creek.

For illustrative purposes in the figures describing Carbon, Organic Nitrogen, Titanium, and Microscopic Evaluation, values equal to or less than those obtained from background samples were assigned a yellow color. There was one exception to this rule; the carbon values for the inlet to Ticonderoga Creek were extremely low (0.1g C/100g of Sed.). Therefore, based on past experience it was arbitrarily decided to set the background carbon content fifteen times higher, i.e., 1.5g C/100g of Sed. (Blue Marine clay of the St. Croix River, Maine has a carbon value of 0.9g C/100g of Sed.) For each parameter measured, a frequency chart of the data was drawn. The values exceeding the background value were then

Data (Cont.)

divided into three approximately equal portions and color coded. With respect to each parameter: blue color, indicates severe pollution; green color, moderately polluted; red color, lightly polluted; and yellow color, pollution free.

For the purpose of discussion, the data will be broken up into three divisions, Ticonderoga Creek, Ticonderoga Bay and the Vermont Shore area. Naturally there is a definite and pronounced interrelationship between the three divisions. These three interrelationships will be discussed subsequent to the discussion of each division separately.

Ticonderoga Creek

A) Amount of Carbon per 100/g of Sediment (O.D.) Figure No. 1, Table No. 1.

This figure shows that the grams of carbon per 100 grams of O.D. sediment is comparatively high, initially, near the mill. As the creek travels away from the mill the amount of carbon in the sediment increases to even higher values than the initial concentration.

There are two anomalies in this figure Both anomalies are real and explanable.

The first anomaly is Station 4. The carbon content of the Creek suddenly and markedly decreases. Since Station 4 is on the inside bend of the creek, the water should be traveling slower and deposition of sediments should occur more readily than at Station 5 which

Ticonderoga Creek (Cont.)

is on the outside bend.

The second anomaly is that farther downstream from the mill complex, the carbon concentration in the sediments of the bank area decreases, with respect to midstream sediment concentration. One would expect, as at Station 4 cited above, that the carbon content would increase near the shore area.

Both situations become quite logical however, if one assumes that the stream is carrying appreciable non-carbonaceous materials and these are being deposited along the banks. Since the data is based on the weight of sediment, it is obvious that deposition of heavy non-carbonaceous material will in effect lower the weight of carbon per 100 grams of sediment.

It is also important to note that as the stream continues to flow away from the mill and town area, the carbon content increases to a maximum value, (a blue color on the map). The only logical explanation for this occurring is the preferential deposition of non-carbonaceous material, close to the mill.

B) Amount of Organic Nitrogen per 100g of Sediment (O.D.) Figure No. 2, Table No. 1.

This is one of the most significant and interesting figures in this report. It is one of the most revealing indirect indicators of the pollution introduced to Ticonderoga Creek and Bay by the International Paper Company complex.

The figure shows that in the upper portion of this stream, nearest the Village of Ticonderoga and the mill complex, the stream is as free from nitrogen pollutants as is Lake George. Yet, it is known that raw sewage from the mill and the Village of Ticonderoga (pop. 11,000+), enters the creek in this area. Indeed the main portion of the creek appears "pure" throughout its entire length.

The only explanation for this apparent purity is an explanation based on the non-nitrogenous loading of the stream by the mill complex. Such reasoning, involving non-nitrogenous loading, is similar to the non-carbonaceous loading rational used to explain the carbon figure.

As was previously pointed out, fly ash is essentially both non-carbonaceous and non-nitrogenous. However, this is not the only known effluent material to fit this description. Clay used for paper filling and coating also fits this requirement. It is known that the majority of paper produced by the mill is very heavily clay filled and (or) clay coated.

Nevertheless, one is faced with the explanation of why the inshore sediment areas farther downstream show an increase in organic nitrogen, i.e., Stations 8, 10, 13, and 14. There is no single clear-cut explanation. Since there is an increasing nitrogen concentration along the shore as the distance along the creek increases, one could reasonably postulate the following:

1. Selective deposition due to density, particle size, etc., of the solid loading of the creek. This means that the material depositing out along the banks has physical characteristics such that there is preferential deposition closer to the mill site. This is really the settling rate factor cited previously and would argue for a heavy clay (papermakers clay), or cinder loading of the stream, rather than fly ash or papermakers TiO_2. This would imply that the non-nitrogenous deposition occurs early in the stream and thus masks any early nitrogen deposition.

2. There are more aquatic plants farther downstream of the mill. This postulate seems reasonable also, since it is well known that Kraft mill effluents are toxic to aquatic life. Presumably, toxicity of these mill wastes are inversely proportional to the distance from the mill.

Neither of the above postulates are mutually exclusive and it is possible that both are operating to various degrees. It is also feasible that still other reasons may dominate and give rise to an increased nitrogen content along the bank.

It should also be noted that the samples from the creek were taken at non-uniform depths due to sampling difficulties. Thus it could be argued, but without subjective validity, that the increase of nitrogen along the shore was not real.

C) Amount of Titanium per 100g of Sediment (O.D.) Figure No 3, Table No. 1.

The Titanium Figure essentially duplicates the Carbon Figure. The amount of titanium per 100g of sediment is lower in the creek area closest to the mill, with the exception of the initial station and progressively increases as the distance from the mill increases. Again this could be attributed to heavy loading of the creek by the mill, with deposition of non-titanium materials occurring early. The pattern of titanium deposition elsewhere along the banks is without the anomalies found in the Carbon data.

Station 9, far downstream of the mill, has a very low titanium content. No explanation is offered for this piece of data.

D) General Discussion of Ticonderoga Creek Data:

All data indicate a very heavy particulate loading of the creek. This is the common and universal characteristic shown by each of the three creek data figures. Collectively these figures indicate that particulate loading is heaviest upstream in the creek where the town and mill are located.

Conversely, the figures all show that the sediments appear to be more polluted farther away from the mill and Town. This is not unexpected since the values of the three parameters are measured in relationship to a hundred grams of oven dry sediment. Thus, a higher initial loading of such particulate materials (clay coating or cinders), would dilute the concentrations of the measured parameters near the mill. As settling out of these heavier substances occurred, and assuming these materials are not themselves composed of C, N, or Ti, it would appear that sediments were becoming more polluted downstream of the Town and mill.

This dilution effect near the mill and Town permits inductive reasoning to the conclusion that the source of sediment loading, as measured by C, N, and Ti, is either the Town or the mill. That is to say, the loading is not natural in origin.

That the International Paper Company complex is primarily responsible for this loading is induced from the following factors:

1. The apparent ultra purity of the creek sediments as measured by nitrogen values, when nitrogen sources are known to exist.
2. Microscopic examination of the sediments (see Figures 7 and 8), which show large amounts of fly ash and cinders; both of which can be attributed to the paper mill complex, based solely on consumptive volume.
3. Creek sediments contain large titanium concentrations.

TICONDEROGA BAY

The section of data involving the creek has, by its very nature, been concerned with the source of pollution.

Conversely this section dealing with Ticonderoga Bay, Lake Champlain, will undergo a subtle shift of emphasis. Pollution of the creek has been established. Therefore, the pollution of Ticonderoga Bay has been established. In this section the emphasis will be on the extent, nature, and characteristics of Bay pollution.

A change of emphasis not withstanding a certain internal consistancy may be anticipated. Those particulate substances containing the parameters measured and which exhibited certain physical characteristics in flowing creek water will exhibit these same physical characteristics in lake water, albeit to different degrees.

For example carbon and titanium containing particulates tend to act in a similar manner. While they do not settle out immediately there is an apparent increase in the settling rate as the stream continues; or stating the converse; the non-carbonaceous and non-titanium materials settle rapidly initially, while the carbon and titanium bearing materials tend to settle at a somewhat slower rate.

For the Bay data to be consistant with the Creek data, carbonaceous and titanium bearing materials must show a continuing concentration effect downstream in the Creek-Bay area. In addition these carbon, titanium containing particulates must follow the creek - lake water interface out into the Bay. The resultant sediment pattern will reflect the creek induced currents within the bay.

This does not imply that the sediment concentrations of carbon and titanium should be similar from area to area. Such similarities would be purely fortuitous since deposition is a function of particle size, density, and water velocity,

The nature of nitrogen bearing particulates is a little more difficult to predict since the sediments of the stream seem pure, on a weight basis, with respect to nitrogen. Thus the physical nature of N bearing particles is somewhat obscure. However, broadly generalizing, these nitrogenous bearing materials do not appear to settle readily. Therefore, one would expect no large nitrogenous sediment deposition at the mouth of the creek. Nevertheless, an increased concentration should be apparent near those points in the bay where the creek water-bay water interface meets to form a zero velocity gradient relative to each other. Hence, the anticipated increase of nitrogenous materials should be away from the mouth of the creek. The main volume of nitrogenous material in the sediment will also lie in the same direction that the creek water flows, before it is completely intermingled with lake waters.

It must also be pointed out that all the data for Ticonderoga Bay, except where noted in the tables, are from samples taken 4.5 to 5.5 feet below the surface of the sediment. This means that there is a historical or time dependent component inherent within the data. Thus the data will demonstrate not only present depositions, but also earlier deposition patterns.

A) Amount of carbon per 100g of Sediment (O.D.), Figure No. 4 Table No. 1.

This figure shows that the main directional thrust of the carbonaceous material coming from the creek is southward.
The two peninsulas are very highly carbonaceous and lends credence to the hypothesis that the peninsulas are composed of non-natural deposits.

In general, the bay appears polluted north and westerly from a line drawn between Station 52 and Station 20.

There are two major anomalies in this map:

1. An apparent clean sediment area comprising an arc from Station 28A thru Station 22.
2. Two clean areas appear at Stations 18 and 32.

There is no cogent explanation as to why Station 18, 22, 28A, and 32 appear as clean water.

It is very significant that the carbonaceous thrust of Ticonderoga Creek apparently exceeds the bounds of this study. This implies the possibility that pollution could sweep south and thence to the eastern bank of Lake Champlain.

Ticonderoga Bay (Cont.)

There is good agreement between the predicted behavior of carbonaceous material in the lake currents and the behavior actually found.

B) Organic Nitrogen per 100g of Sediment (O.D.), Figure No. 5, Table No. 1

The concentration of organic nitrogen remains very low in creek sediment between the two peninsulas; as shown on Figure No. 5.

Immediately upon entering the Bay, the concentration increases with the majority of the nitrogenous material appearing within a triangle, with vertices at Station 36, Station 50, and Station 54. The general location of this area of highly nitrogenous sediments is not unexpected and had been predicted earlier in this report.

It is significant that the major directional thrust of nitrogenous pollution is southward, as was the case with carbonaceous pollution.

The fact that nitrogenous pollution is indicated southward, beyond the extent of the study bounds, again implies, that pollution could be carried southward and there upon to the eastern shore of Lake Champlain. There are no obvious explanations why nitrogen concentrations should be so high at Stations 6, 13, 14, and 21. These are contiguous areas and the concentrations are real. Stations 10 and 12 also show heavily nitrogenous deposits. It is possible that all these deposits were laid down at a time before the peninsulas were formed. These deposits could then be considered as historical deposits.

To generalize, in terms of the limits of this study, unnatural nitrogenous sediments lie to the north and west of a line drawn through Station 52 and Station 20.

C) Amount of Titanium per 100g of Sediment (O.D.), Figure No. 6, Table No. 1.

The Figure shows a high concentration of titanium located in the sediment between the two peninsulas. This is consistant with results shown in Figure 3 of the Creek.

However, while this titanium Figure indicates a Bay deposition in the same southerly direction, shown in the two previous Bay charts, there is an angular eastwardly thrust of sedimentation not previously apparent.

This angular deposition is probably a reflection of particle size and density of the titanium bearing particulate.

Unlike the other two figures, the area of severe (blue), titanium pollution does not extend to the bounds of this study. This implies that at least the majority of the titanium bearing particulates are of such size, shape, and density so as to have comparatively short settling rates.

The west peninsula in particular contains large titanium concentrations, thus implying a non-natural composition.

As on the two previous figures, all major titanium polluted depositions

Ticonderoga Bay (Cont.) (C)

occur to the north and west of a line drawn through Station 52 and Station 20.

VERMONT SHORE STATIONS

Three Stations (55, 56, and 57), were taken along the Vermont Shore side of Lake Champlain.

Station 55 is located at Bouy 39 Marina, which is approximately one mile south of Ticonderoga Creek and on the eastern shore.

Station 56 was located at Catfish Bay, which is 0.8 miles south of Ticonderoga Creek and on the eastern shore.

Station 57 is approximately 20 feet from the Vermont Shore, due east of Fort Ticonderoga.

All samples were taken approximately 2.5 feet below sediment level. Station 55 and 56 had approximately 7.0 feet of water over the surface of sediment.

Station 57 had approximately 18 feet of water over the surface of the sediment. These stations were not included in the joint FWPCA, USA Engineers Corps' planning.

Data

A) Amount of Carbon per 100g of Sediment (O.D.), Table No. 1

All three sample station indicate a severe to moderate carbonaceous pollution of sediments. As was pointed out previously, this parameter is a general pollution indicator and does not indicate source.

B). Amount of Organic N per 100g of Sediment (O.D.), Table No. 1

Both Station 55 (Buoy 39 Marina), and Station 56 have 0.06g of Organic N per 100g of Sediment (O.D.), i.e., 0.06%. This value is of a low magnitude, the sediments are just barely classifiable as moderately polluted. Station 57, (value 0.03%) is classified as lightly polluted.

C) Amount of Titanium per 100g of Sediments (O.D.), Table No. 1

Station 55 and Station 57 both show moderate titanium loading of the sediment.

Station 56, Catfish Bay, shows lightly polluted sediments with respect to titanium.

D) General Discussion

Each of the three stations indicated at least a moderate pollution load for two of the three parameters measured in this study. Nevertheless, any general definitive statements as to pollution of Vermont sediments would be unjustifiable and undefendable based on results of only these three stations.

The basic difficulty is the lack of data. Three stations scarcely characterize, in a definitive manner, a half mile of shore line.

Vermont Shore Stations (Cont.) (D)

As was previously stated, two of the parameters measured (carbon and organic nitrogen) in the Ticonderoga Bay portion of this study indicated that severe pollution loading of the sediments occurred adjacent to the geographic limits of the study.

It has been recorded that a northerly wind actually reverses the natural northward flow of the Lake and thus increases the likelyhood of sediment loading south and east of Ticonderoga Bay. However, this study can in no way verify that such sediment loading does exist on the Vermont Shore since the number of samples is insufficient to substantiate any conclusions.

CONCLUSIONS

The purposes of this report have been stated as:

1. Determine whether or not a chemical basis exists for stating the degree of sediment pollution of Ticonderoga Creek and Ticonderoga Bay.
2. If sediment pollution exists, determine its nature, location, magnitude and major source.

As determined by chemical tests, pollution does exist in Ticonderoga Creek and Ticonderoga Bay. Bay pollution exists at the four to five foot depth level.

The major source of the pollution appears to be the Ticonderoga Division

Conclusions (Cont.)

of the International Paper Company.

All major deposits of polluted sediments in the Bay lie to the north and west of a line drawn through Stations 52 and 20 on the figures of Ticonderoga Bay.

REFERENCES

1) Brauns, F. and Brauns, D., The Chemistry of Lignin. Supplement Volume 1949-1958, Adacemic Press, N.Y. 1960: p 227

2) Stenger, R.L., "The Spectrographic Analyzer and Computer-assisted Data Reduction", American Laboratory, July, 1969

3) Private communication, Dana Doloff, Paper Engineer, Ticonderoga Division, International Paper Company, May, 1969.

4) U.S. FWPCA, Official Interim Methods for Chemical Analysis of Surface Waters. Sept., 1968

5) ibid

6) ________"Analytical Methods for Atomic Absorption Spectrophotometry", September, 1968, Perkin-Elmer Corp., Norwalk, Conn.

7) Eidam, C., "Microscopic Evaluation of Lake Champlain Sediments", NEBO Memo, June 16, 1969. (Appended this Report).

TABLE I

SUMMARY OF DATA - TICONDEROGA CREEK - TICONDEROGA BAY SURVEY

Area or Special Identification	Station Ident.	Sample Depth in Feet	g of Carbon / 10^2g of Sed.(OD)	g of Organic N / 10^2g of Sed.(OD)	g of Ti X 10^{-2} / 10^2g of Sed.(OD)
Lake George Back-ground Sample	L-1	0.0	0.1	1.78	0.7
Ticonderoga Creek	DH-S-1	0.5	5.5	0.01	3.2
"	DH-S-2	2.5	4.7	0.01	0.9
"	DH-S-3	1.5	3.3	0.02	1.1
"	DH-S-4	2.0	1.5	0.00	1.3
"	DH-S-5	2.5	5.8	0.00	2.4
"	DH-S-6	0.5	8.7	0.01	1.9
"	DH-S-7	5.0	5.5	0.03	1.5
"	DH-S-8	5.0	7.2	0.05	1.2
"	DH-S-9	2.5	10.1	0.00	0.9
"	DH-S-10	2.5	12.6	0.05	4.2
"	DH-S-11	5.0	5.8	0.07	3.6
"	DH-S-12	5.0	13.6	0.01	3.5
"	DH-S-13	3.0	5.9	0.06	4.7
"	DH-S-14	5.0	6.5	0.06	-
"	DH-A	4.5	7.1	0.07	7.4
"	DH-B	5.0	5.8	0.06	4.6
"	DH-C	4.0	15.1	0.14	2.0
Ticonderoga Bay	DH-1	4.5	6.2	0.09	6.2
"	DH-2	2.5	16.7	0.01	7.4
"	DH-3	4.5	6.9	0.08	4.0
"	DH-4	5.0	5.4	0.06	3.6
"	DH-6	4.5	13.9	0.14	5.3
"	DH-7	4.5	5.2	0.02	2.8
"	DH-8	5.0	17.1	0.07	8.8
"	DH-8A	5.0	13.6	0.01	3.4
"	DH-9	5.0	6.4	0.08	2.3

TABLE I (CONT.)

Area or Special Identification	Station Ident.	Sample Depth in Feet	g of Carbon / 10^2g of Sed.(OD)	g of Organic N / 10^2g of Sed.(OD)	g of Ti X 10^{-2} / 10^2g of Sed.(OD)
Ticonderoga Bay	DH-10	4.5	5.6	0.50	2.8
"	DH-11	4.5	5.7	0.07	6.0
"	DH-12	4.5	4.5	0.33	8.8
"	DH-13	4.5	12.5	0.11	2.5
"	DH-14	6.5	5.2	0.10	7.0
"	DH-15	4.5	13.8	0.03	8.0
"	DH-16	5.0	18.9	0.06	11.4
"	DH-17	5.0	9.6	0.06	7.5
"	DH-18	5.0	1.5	0.07	5.4
"	DH-19	4.5	3.4	0.08	5.6
"	DH-20	4.5	2.3	0.06	5.5
"	DH-21	4.5	6.4	0.09	5.1
"	DH-22	5.0	0.1	0.03	1.8
"	DH-23	5.0	27.9	0.04	5.2
"	DH-24	5.0	5.0	0.08	4.0
"	DH-25	5.0	1.6	0.04	2.3
"	DH-26	5.0	2.4	0.06	4.5
"	DH-27	4.5	2.0	0.05	0.6
"	DH-28A	4.0	1.0	0.03	10.5
"	DH-29-1W	4.5	31.6	0.02	2.9
"	DH-30	6.5	7.3	0.06	3.5
"	DH-31	5.0	2.5	0.05	2.2
"	DH-32	3.0	1.0	0.04	4.3
"	DH-33	4.5	2.6	0.05	2.1
"	DH-35A	3.0	1.8	0.05	3.9
"	DH-36	4.5	10.4	0.18	5.8

TABLE I (CONT.)

Area or Special Identification	Station Ident.	Sample Depth in Feet	$\frac{\text{g of Carbon}}{10^2\text{g of Sed.(OD)}}$	$\frac{\text{g of Organic N}}{10^2\text{g of Sed.(OD)}}$	$\frac{\text{g of Ti X } 10^{-2}}{10^2\text{g of Sed.(OD)}}$
Ticonderoga Bay	DH-37	6.5	>67.3	0.02	14.7
"	DH-39	5.0	1.6	0.04	2.0
"	DH-40	4.5	2.1	0.04	2.0
"	DH-41	3.0	1.3	0.04	2.8
"	DH-42	2.0	2.5	0.05	1.9
"	DH-43	4.5	7.2	0.10	3.0
"	DH-44	4.5	4.2	0.10	1.6
"	DH-45	3.0	3.3	0.12	3.1
"	DH-46	2.5	1.7	0.06	5.6
"	DH-47	4.5	2.1	0.06	1.9
"	DH-48	2.5	0.8	0.03	4.9
"	DH-49	1.0	4.2	0.05	1.6
"	DH-50	4.5	7.0	0.11	2.9
"	DH-51	4.5	4.0	0.11	2.3
"	DH-52	4.5	2.2	0.07	3.0
"	DH-53	4.5	1.9	0.05	4.5
"	DH-54	5.0	1.8	0.07	1.4
Buoy 39, Vermont Shore	DH-55	2.5	3.7	0.06	4.2
Catfish Bay, Vermont Shore	DH-56	2.4	11.4	0.06	1.8
East Creek Point Vermont Shore	DH-57	2.5	5.1	0.03	4.1
Coal Ash-Grab Sample off Ground	F - 1	-	18.8	0.00	4.0

TABLE II

LAKE CHAMPLAIN SEDIMENTS

MICROSCOPIC EXAMINATION

Station	Depth	Materials Present	% Composition
TICONDEROGA CREEK			
DH-S-1	No Sample @ 2.5' Depth		
DH-S-2	2.5	Gravel	95
		Flyash	5
DH-S-3	2.5	Gravel	100
DH-S-4	2.5	Gravel	85
		Flyash	15
DH-S-5	2.5	Gravel	75
		Flyash	25
DH-S-6	3.0	Gravel	85
		Flyash & Coal	15
DH-S-7	3.0	Silt	90
		Flyash	5
		Wood Chips	5
DH-S-8	No Sample @ 2.5' Depth		
DH-S-9	2.5	Gravel	80
		Coal & Flyash	20
DH-S-10	2.5	Silt	90
		Flyash	10
DH-S-11	3.0	Silt	65
		Fibrous Material	15
		Flyash	10
		Bark	10
DH-S-12	3.0	Gravel	90
		Coal & Flyash	5
		Wood Chips	5
DH-S-13	2.5	Silt	90
		Fibrous Material	5
		Wood Chips & Bark	5

TABLE II (CONT.)

Station	Depth	Materials Present	% Composition
TICONDEROGA CREEK (CONT.)			
DH-S-14	3.0	Silt	70
		Fibrous Material	5
		Wood Chips	10
		Bark	15
LAKE CHAMPLAIN			
DH-1	4.5	Silt	50
		Fibrous Material	45
		Gravel	5
DH-1A	No Sample @ 4.5' Depth		
DH-2	No Sample @ 4.5' Depth		
DH-3	4.5	Silt	60
		Bark	30
		Fibrous Material	10
DH-4	5.0	Silt	70
		Bark	10
		Wood Chips	15
		Fibrous Material	5
DH-5	No Sample @ 4.5' Depth		
DH-6	4.5	Silt	80
		Fibrous Material	5
		Bark & Wood Chips	15
DH-7	4.5	Silt	75
		Bark	20
		Fibrous Material	5
DH-8	5.0	Silt	30
		Wood Chips	50
		Flyash	5
		Fibrous Materials	10
		Bark	5

TABLE II (CONT.)

Station	Depth	Materials Present	% Composition
LAKE CHAMPLAIN (CONT.)			
DH-8A	5.0	Flyash	85
		Wood Chips & Bark	15
DH-9	5.0	Silt	40
		Fibrous Material	5
		Bark	55
DH-10	4.5	Silt	60
		Bark	30
		Fibrous Material	10
DH-11	4.5	Silt	90
		Fibrous Material	5
		Bark & Wood Chips	5
DH-12	5.0	Silt	90
		Fibrous Material	5
		Wood Chips & Bark	5
DH-13	4.5	Silt	50
		Bark	20
		Flyash	10
		Wood Chips	10
		Fibrous Materials	10
DH-14	4.5	Silt	90
		Bark	5
		Flyash	5
DH-15	4.5	Silt	90
		Fibrous Material	5
		Wood Chips & Bark	5
DH-16	5.0	Silt	5
		Wood Chips	70
		Bark	25
DH-17	5.0	Silt	95
		Wood Chips & Bark	5

TABLE II (CONT.)

Station	Depth	Material Present	% Composition
LAKE CHAMPLAIN (CONT.)			
DH-18	5.0	Silt - Sand	100
DH-19	4.5	Silt Flyash	90 10
DH-20	4.5	Silt - Sand	100
DH-21	4.5	Silt Fibrous Material Bark & Wood Chips	60 10 30
DH-22	5.0	Silt - Clay Flyash	100 Trace
DH-23	5.0	Silt Flyash Wood Chips & Bark	20 50 30
DH-24	5.0	Silt Bark Fibrous Material	50 45 5
DH-25	5.0	Silt Bark & Wood Chips	90 10
DH-26	5.0	Silt - Clay Flyash	100 Trace
DH-27	4.5	Silt - Clay	100
DH-28	4.5	Silt Flyash	100 Trace
DH-28A	4.5	Flyash Wood Chips	75 25
DH-29	5.0	Silt Wood Chips Flyash	60 10 30
DH-30	4.5	Silt - Clay Flyash	100 Trace

TABLE II (CONT.)

Station	Depth	Materials Present	% Composition
LAKE CHAMPLAIN (CONT.)			
DH-31	5.0	Silt - Sand	100
DH-32	5.0	Silt - Sand	100
DH-33	4.5	Silt - Sand	100
DH-34	No Sample @ 4.5' Depth		
DH-35	4.5	Silt - Clay Flyash	100 Trace
DH-35A	3.0	Silt - Clay Flyash	60 40
DH-36	4.5	Silt Flyash Wood Chips & Bark	90 10 Trace
DH-37	4.5	Flyash Wood Chips	75 25
DH-38	4.5	Silt - Clay	100
DH-39	5.0	Silt - Clay	100
DH-40	4.5	Silt - Clay Flyash	95 5
DH-41	5.0	Silt - Sand	100
DH-42	3.0	Silt - Clay	100
DH-43	4.5	Silt - Clay	100
DH-44	4.5	Silt - Clay	100
DH-45	3.0	Silt - Clay	100
DH-46	4.5	Silt	100
DH-47	4.5	Silt - Sand	100
DH-48	4.5	Silt - Clay	100

TABLE II (CONT.)

Station	Depth	Materials Present	% Composition
LAKE CHAMPLAIN (CONT.)			
DH-49	3.0	Silt - Clay	100
DH-50	4.5	Silt	60
		Bark	30
		Fibrous Material	10
DH-51	4.5	Silt	80
		Bark	20
DH-52	4.5	Silt	100
DH-53	4.5	Silt - Clay	100
DH-54	5.0	Silt - Clay	100

CARBON CONCENTRATION IN SLUDGE DEPOSITS
TICONDEROGA CREEK, TICONDEROGA, N.Y.

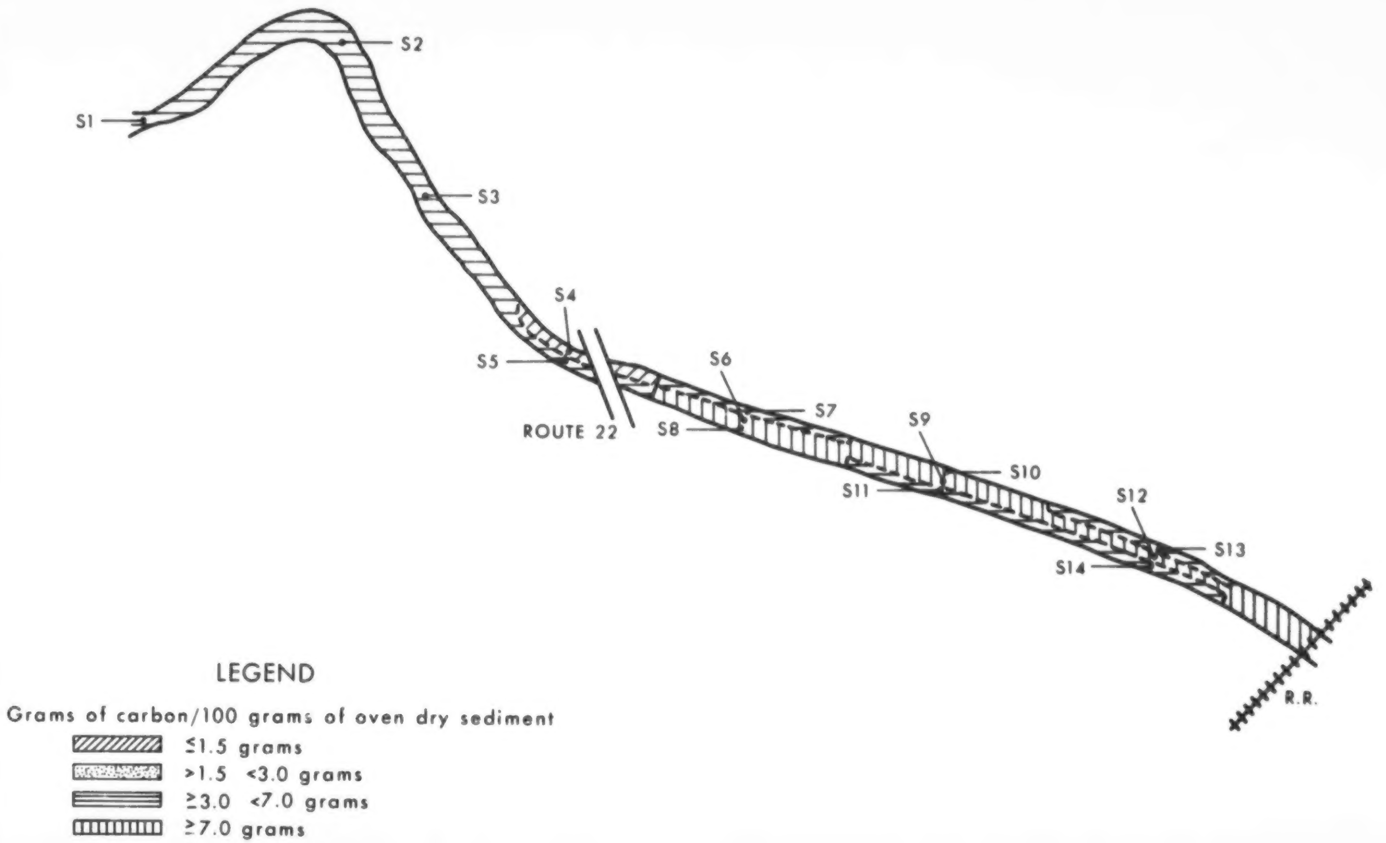

S1
S2
S3
S4
S5
ROUTE 22
S6
S7
S8
S9
S10
S11
S12
S13
S14
R.R.
LEGEND
Grams of carbon/100 grams of oven dry sediment
▨ ≤1.5 grams
▒ >1.5 <3.0 grams
▤ ≥3.0 <7.0 grams
▥ ≥7.0 grams

FIGURE 1

ORGANIC NITROGEN CONCENTRATION IN SLUDGE DEPOSITS
TICONDEROGA CREEK, TICONDEROGA, N.Y.

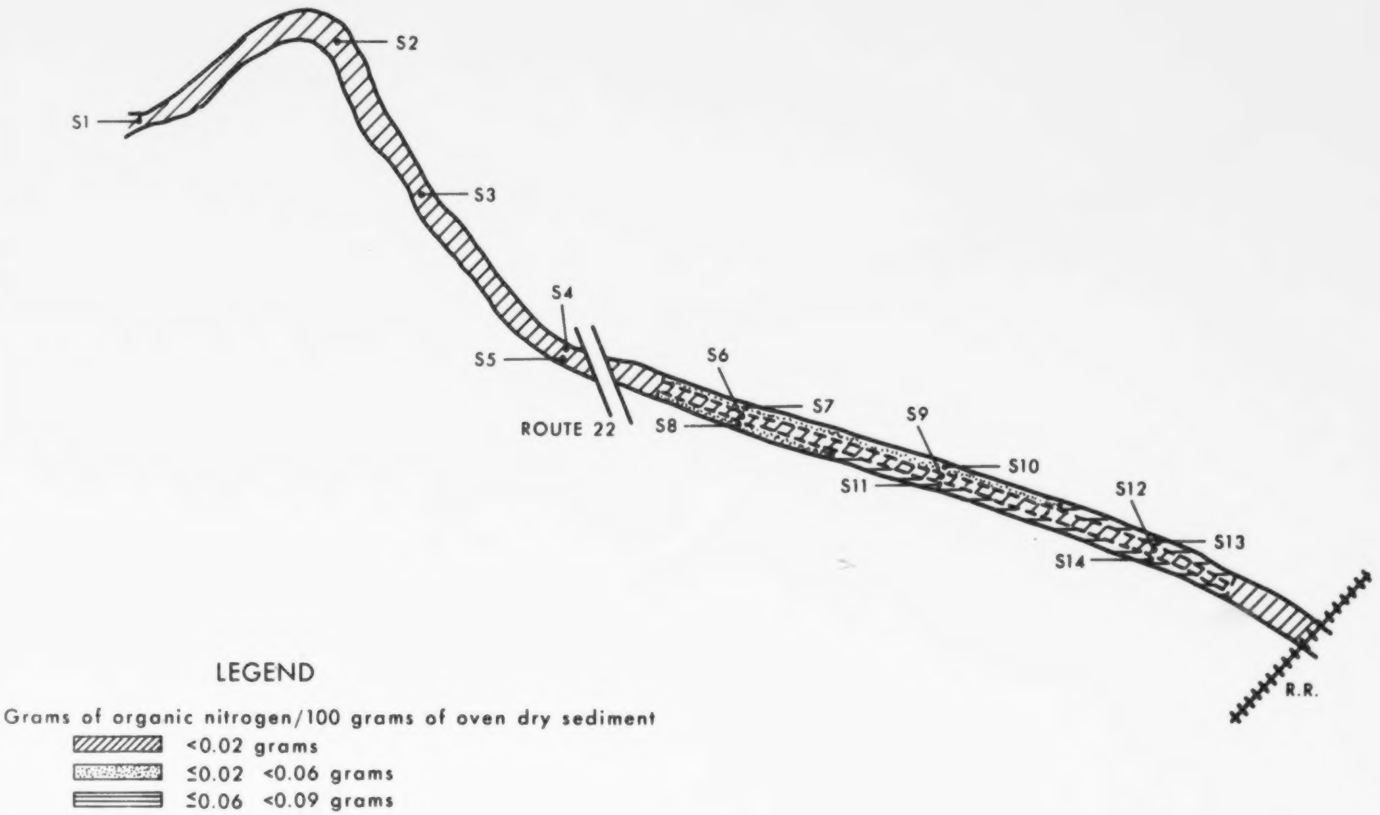

S1
S2
S3
S4
S5
ROUTE 22
S6
S7
S8
S9
S10
S11
S12
S13
S14
R.R.
LEGEND
Grams of organic nitrogen/100 grams of oven dry sediment
▨ <0.02 grams
▨ ≤0.02 <0.06 grams
▤ ≤0.06 <0.09 grams

FIGURE 2

TITANIUM CONCENTRATION IN SLUDGE DEPOSITS
TICONDEROGA CREEK, TICONDEROGA, N.Y.

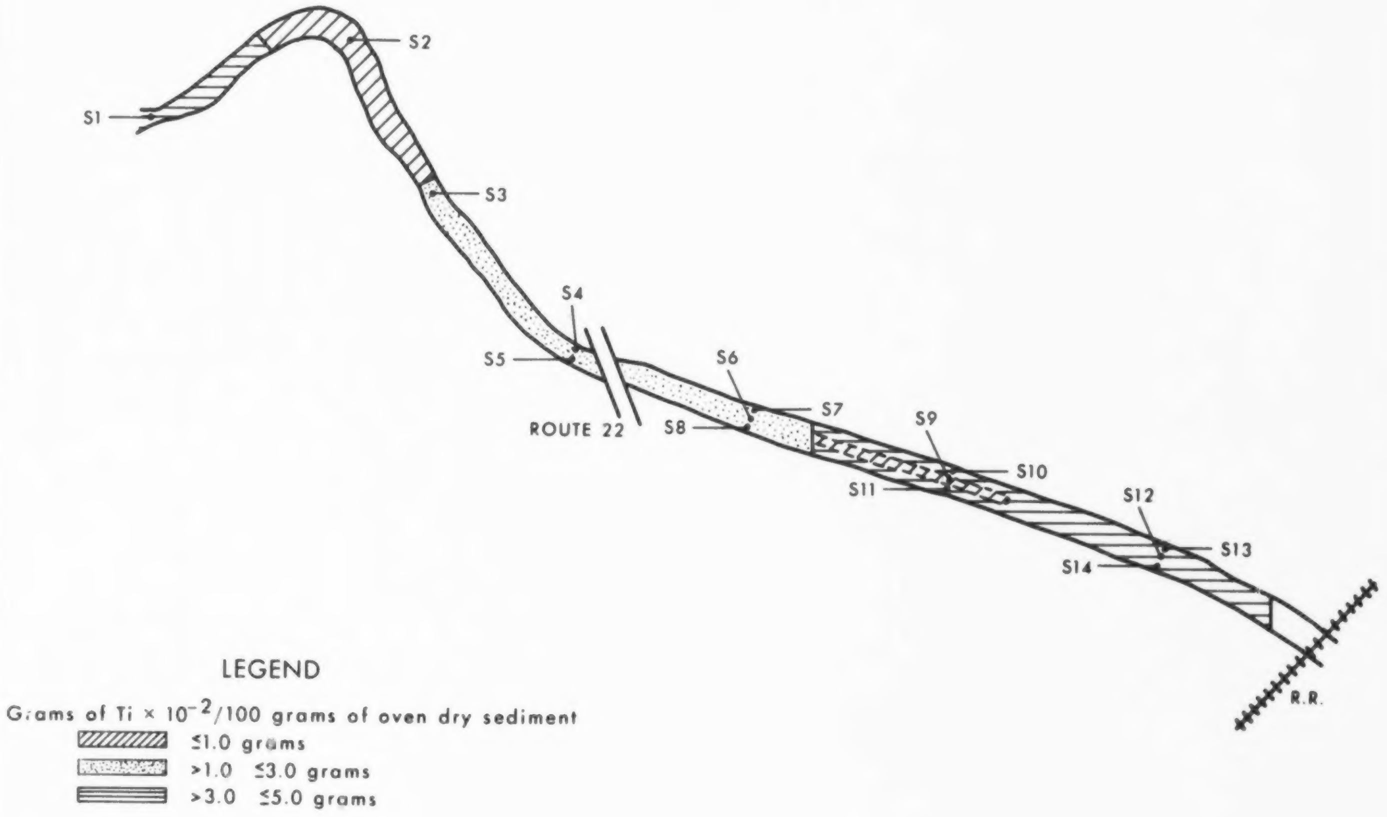

S1
S2
S3
S4
S5
ROUTE 22
S6
S7
S8
S9
S10
S11
S12
S13
S14
R.R.
LEGEND
Grams of Ti × 10⁻²/100 grams of oven dry sediment
▨ ≤1.0 grams
▒ >1.0 ≤3.0 grams
▤ >3.0 ≤5.0 grams

FIGURE 3

CARBON CONCENTRATION IN SLUDGE DEPOSITS TICONDEROGA BAY, LAKE CHAMPLAIN

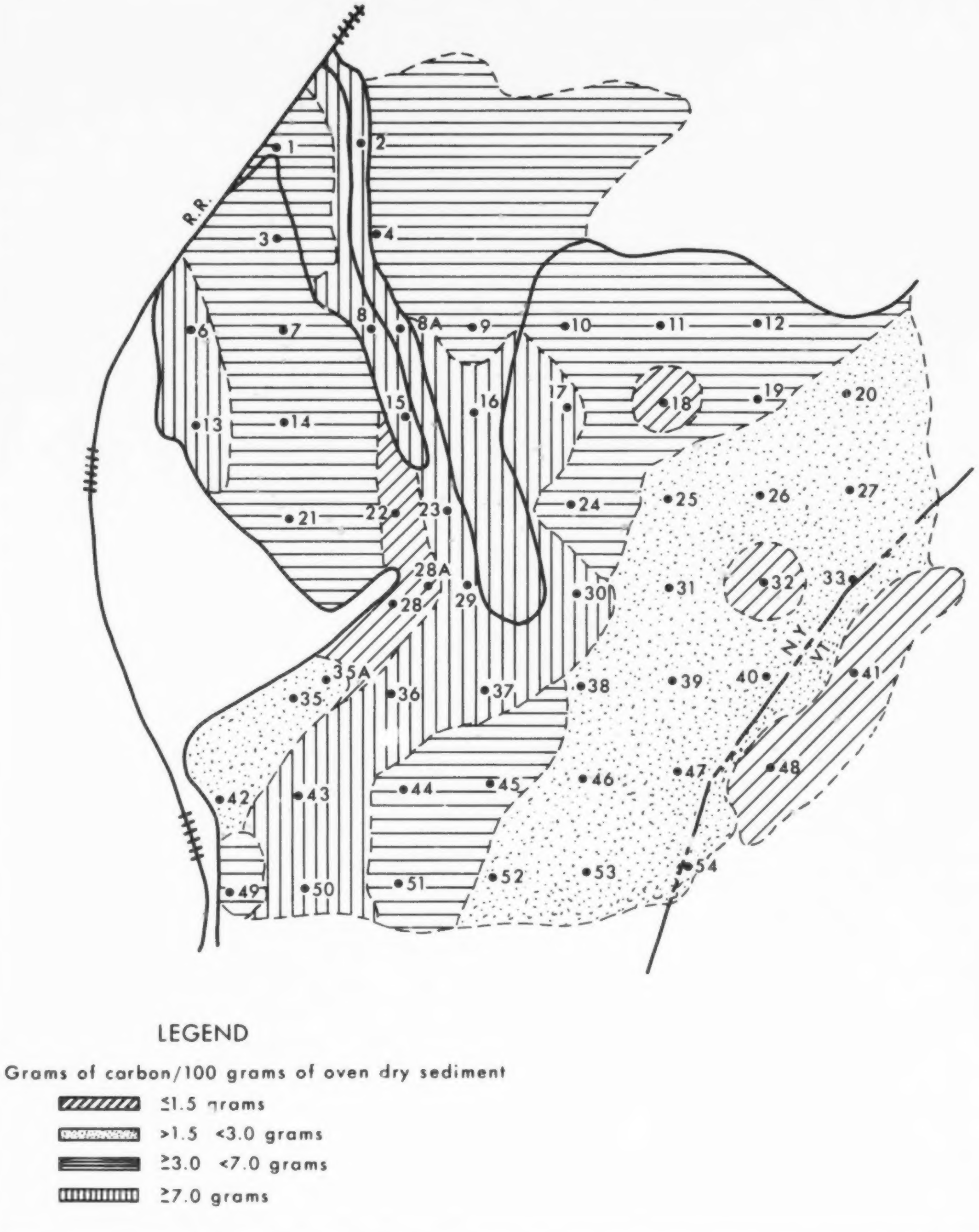
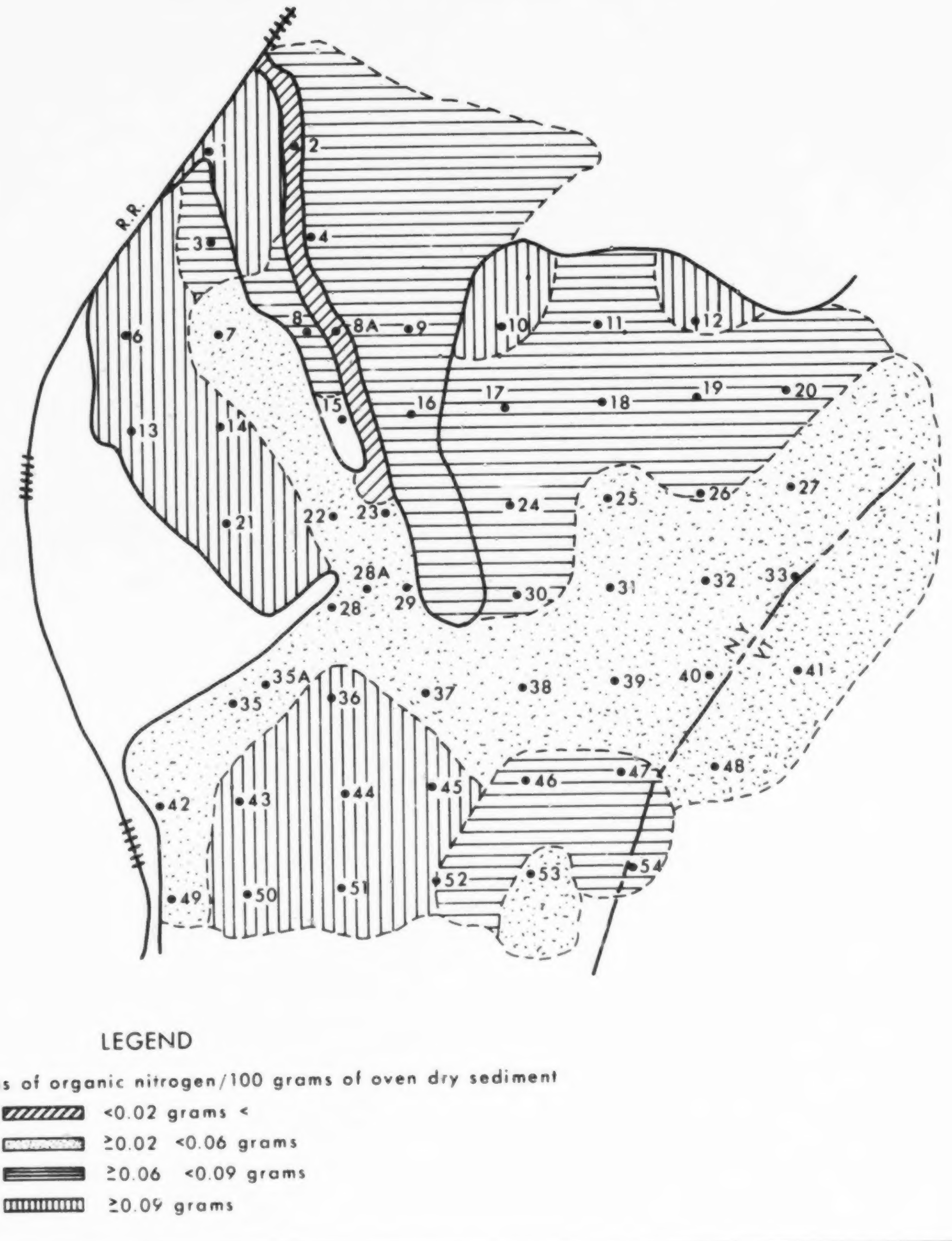

R.R.
1
2
3
4
6
7
8
8A
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28A
28
29
30
31
32
33
N.Y.
VT.
35A
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
LEGEND
Grams of carbon/100 grams of oven dry sediment
▨ ≤1.5 grams
▨ >1.5 <3.0 grams
▤ ≥3.0 <7.0 grams
▥ ≥7.0 grams

FIGURE 4

ORGANIC NITROGEN CONCENTRATION IN SLUDGE DEPOSITS TICONDEROGA BAY, LAKE CHAMPLAIN


R.R.
1
2
3
4
6
7
8
8A
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28A
28
29
30
31
32
33
N.Y.
VT.
35A
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54

LEGEND

Grams of organic nitrogen/100 grams of oven dry sediment

▨ <0.02 grams <
░ ≥0.02 <0.06 grams
▤ ≥0.06 <0.09 grams
▥ ≥0.09 grams

FIGURE 5

TITANIUM CONCENTRATION IN SLUDGE DEPOSITS TICONDEROGA BAY, LAKE CHAMPLAIN

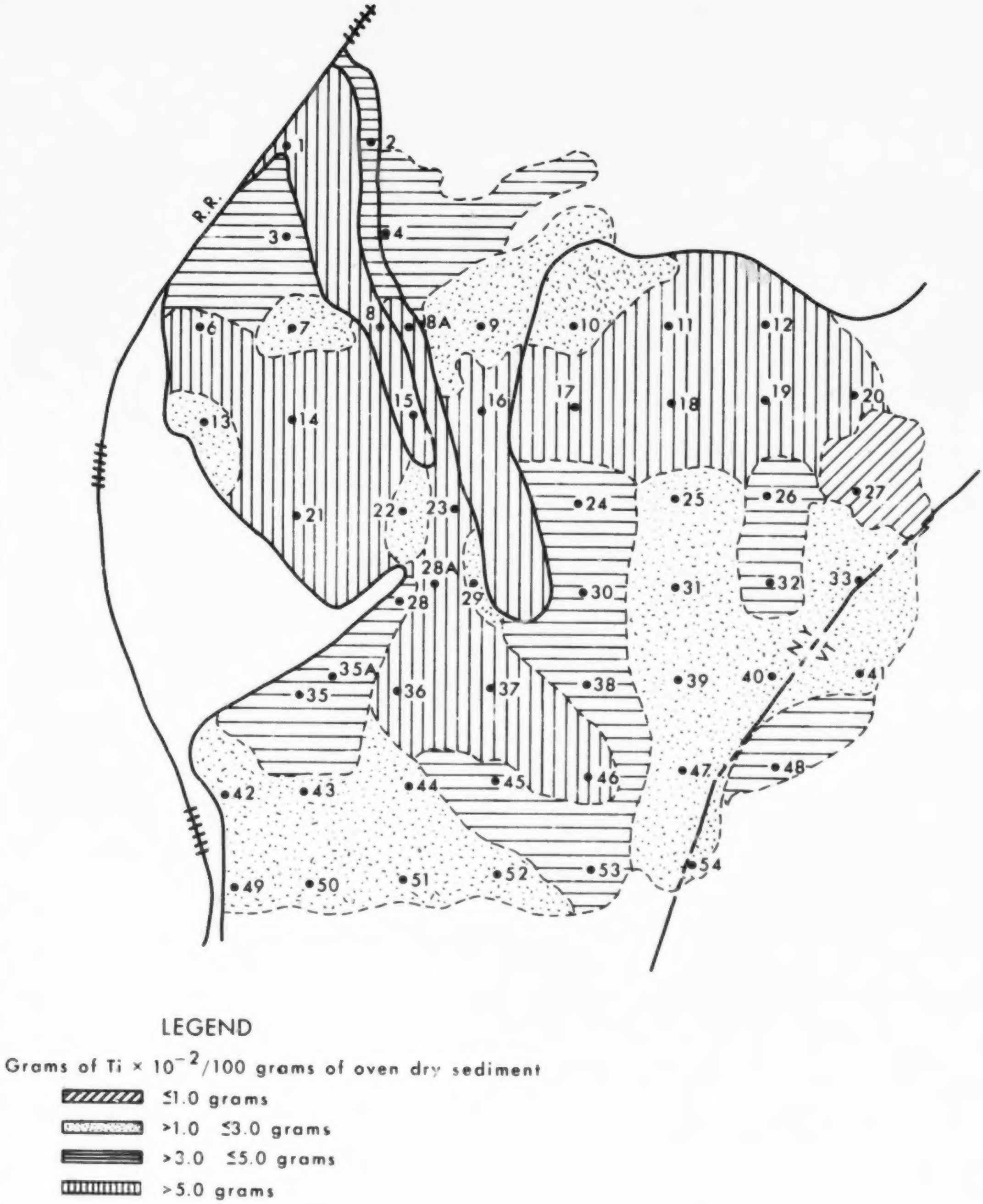

R.R.
1
2
3
4
6
7
8
8A
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28A
28
29
30
31
32
33
35A
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
N.Y.
VT.
LEGEND
Grams of Ti × 10⁻²/100 grams of oven dry sediment
≤1.0 grams
>1.0 ≤3.0 grams
>3.0 ≤5.0 grams
>5.0 grams

FIGURE 6

MICROSCOPIC EVALUATION TOTAL POLLUTION DEPOSITION TICONDEROGA CREEK, TICONDEROGA, N.Y.

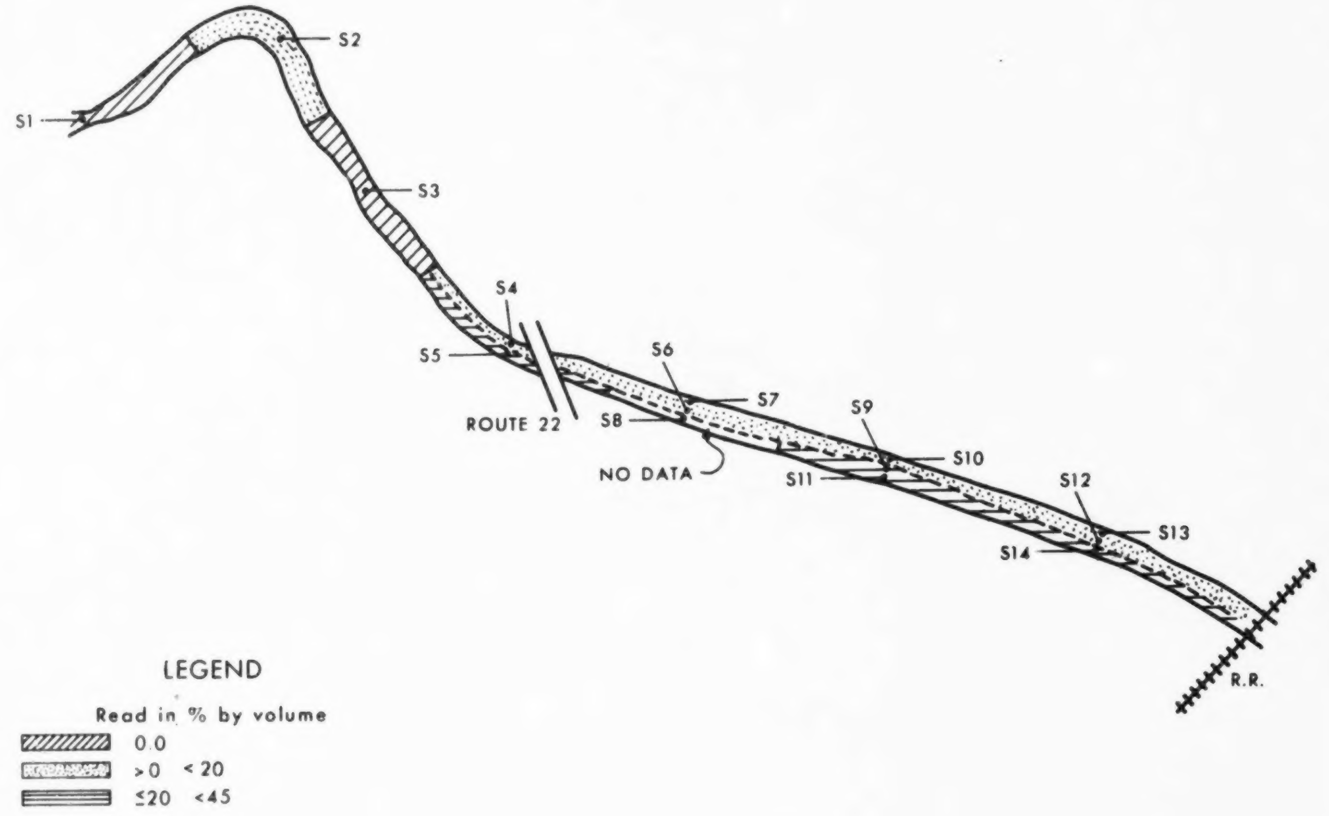

S1
S2
S3
S4
S5
ROUTE 22
S6
S7
S8
NO DATA
S9
S10
S11
S12
S13
S14
R.R.
LEGEND
Read in % by volume
0.0
>0 <20
≤20 <45

FIGURE 7

MICROSCOPIC EVALUATION TOTAL POLLUTION DEPOSITION
TICONDEROGA BAY, LAKE CHAMPLAIN

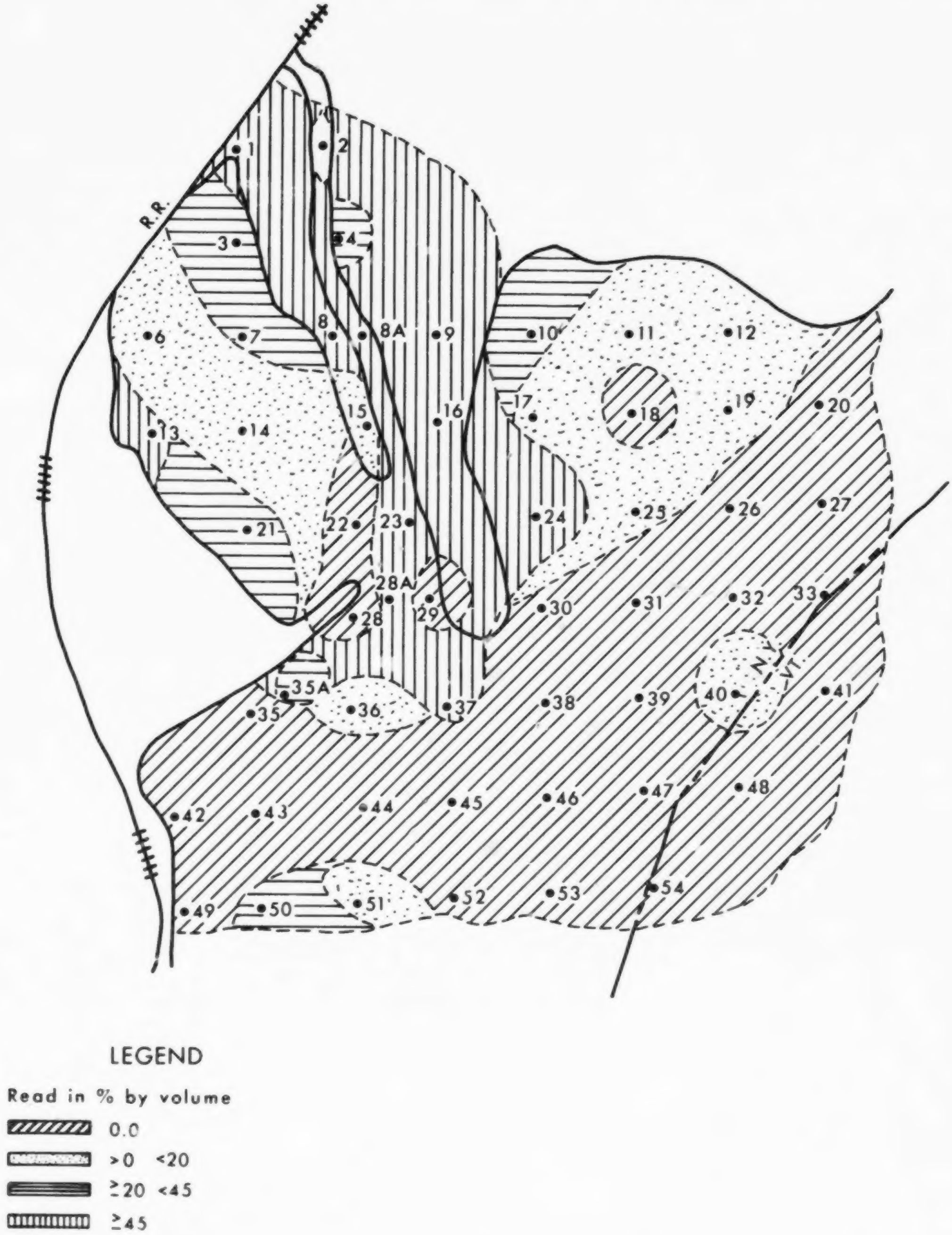

R.R.
1
2
3
4
6
7
8
8A
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28A
28
29
30
31
32
33
35A
35
36
37
38
39
40
41
N.Y.
VT.
42
43
44
45
46
47
48
49
50
51
52
53
54
LEGEND
Read in % by volume
▨ 0.0
▒ >0 <20
▤ ≥20 <45
▥ ≥45

FIGURE 8

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : Warren H. Oldaker
Chief, Laboratory Branch

DATE: June 16, 1969

FROM : Carl L. Eidam Carl L. Eidam
Operations Review Section

SUBJECT: Microscopic Evaluation of Lake Champlain Sediments.

Microscopic examination of sediments from the Fort Ticonderoga area of Lake Champlain has been completed. Deposition of unnatural materials in the study area included fly ash, paper fibers, wood chips, and strips of bark.

Core samples were cut into one foot section in the field. Each individual fraction was separately packaged. Analysis was performed by first thoroughly mixing each fraction, then removing an aliquot portion to a petri dish. Microscopic examination under 100X magnification proved to be sufficient to recognize all major components of sediment. By this method an estimate of the percent composition of various components was made. Replicate analysis of three stations showed this method to be relatively precise, with no major descrepancies in estimated percent composition demonstrated.

Ticonderoga Creek

All stations in Ticonderoga Creek (see Fig. 1A) exhibited fly ash deposition ranging from 5% - 30% of the top foot of sediment by volume. An exception to this occurred at Station S-6 where no deposition of any unnatural materials was noted. The decrease in stream width at this Station with an accompanying increase in flow rates probably precludes the deposition of suspended solids in this area, thus bringing about the condition noted. Bark, wood chips, and paperfiber deposition was present in the lower (southerly) portions of the stream due to decreases in flow rates which bring about deposition of lighter materials.

Samples taken from the 2.5 foot depth of sediment in Ticonderoga Creek reflected depositional loadings somewhat less than is indicated for present trends. The presence of fly ash at this depth, however, implicates the same source of these materials as is presently being investigated.

Lake Champlain

Figure 2 shows the extent and direction of deposition in the top foot of sediment of Lake Champlain near Ticonderoga Creek. Maximum amounts of wood chips and bark deposition occurred in the area west of the mouth of Ticonderoga Creek, while maximum fly ash deposition occurred immediately

5010-108

Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

south of the Creek.

Of the 54 stations sampled on the New York side of Lake Champlain, only two showed no effects from the influx of solids into the area: Stations 27 and 32. Four Stations (54, 55, 56, and 57) were sampled on the Vermont side of Lake Champlain. Stations 54, 56, and 57 showed no signs of deposition of wood products of fly ash, while Station 55 did have a small amount of bark present. However, this small amount (<5%) could have occurred as a result of natural conditions.

Samples examined from the 4.5' depth of sediment indicated the same general deposition pattern as surface sediments, but to a lesser degree. Deposition values of greater than 50% by volume (see Fig. 8) were present in the southerly reach of Ticonderoga Creek from Station 1A and extended into the Bay as far as Station 37. The peninsulas formed at the mouth of Ticonderoga Creek also reflected this high pollutional deposition. Deposition values ranging from greater than trace to less than 45% by volume were confined mostly to the cove areas immediately east and west of the mouth of Ticonderoga Creek.

Except for one or two isolated cases, other stations in Ticonderoga Bay exhibited only traces of fly ash, woodchips, bark, or fibrous materials at the 4.5' depth of sediment.

Miscellaneous Stations

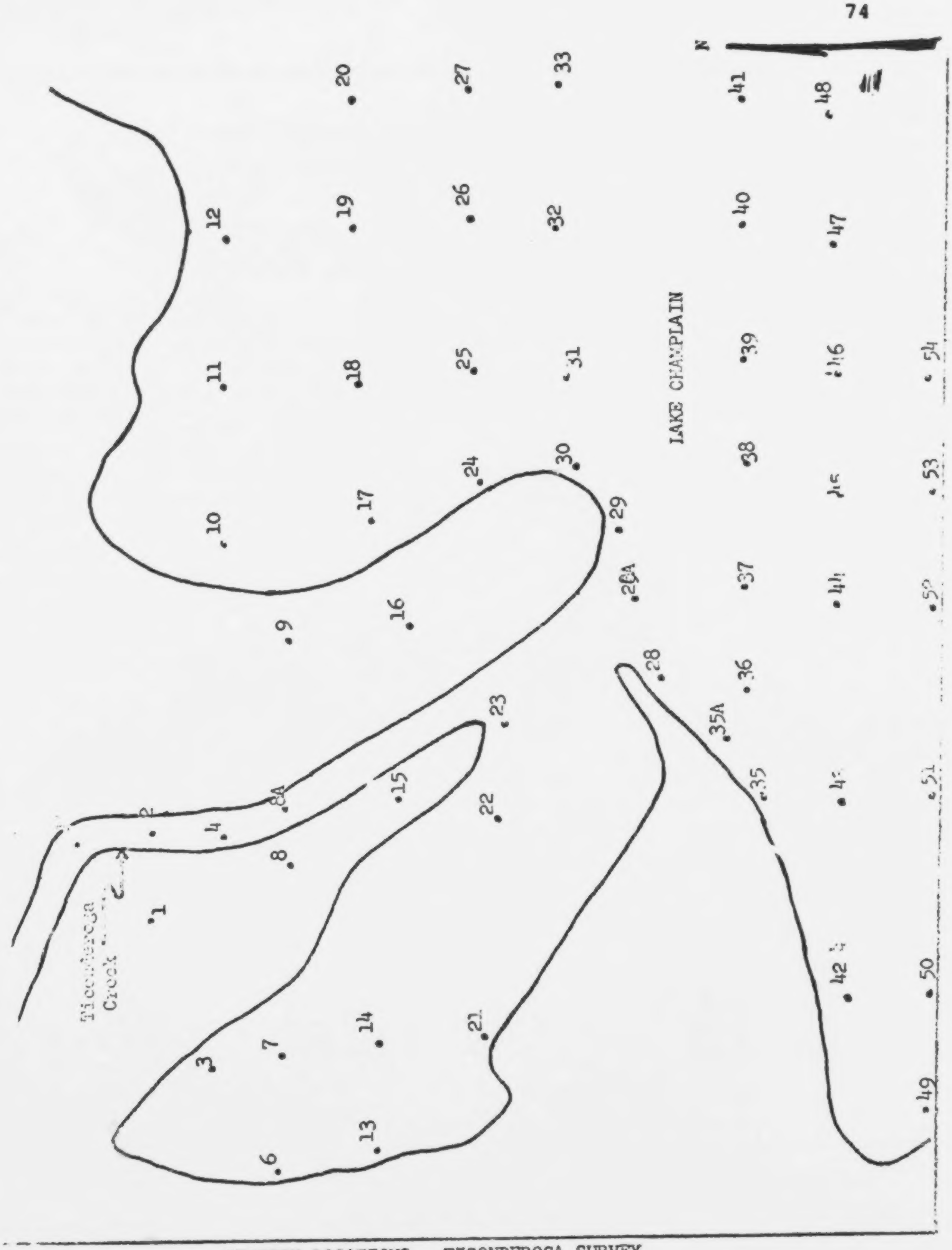
Lake George - Background samples obtained in Lake George were composed entirely of coarse sand with no visible deposition of pollutional materials.

New Plant

Approximately one mile north of the mouth of Ticonderoga Creek, a new plant site is being proposed. Samples taken at the proposed influent and effluent sites showed a bottom composed entirely of clay with no evidence of unnatural deposition.

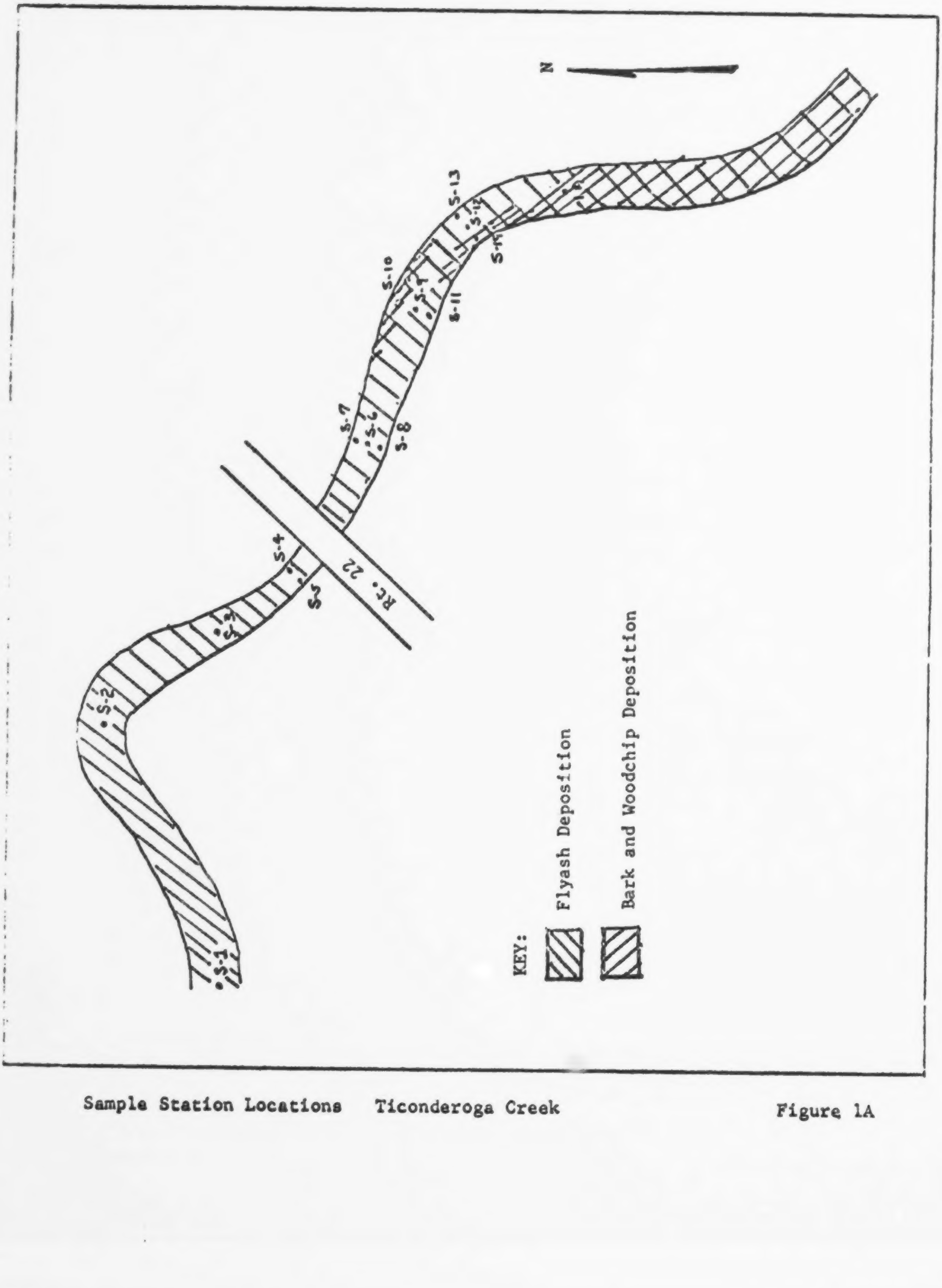
Depth of Deposits

The actual depth of deposits in the study area varied greatly from station to station. In many cases the actual maximum depth of deposits was not possible to determine, as the core did not penetrate to the natrual bottom. Because of this, I will not try to estimate the volume of deposits present, as the figure would probably be grossly inaccurrate.

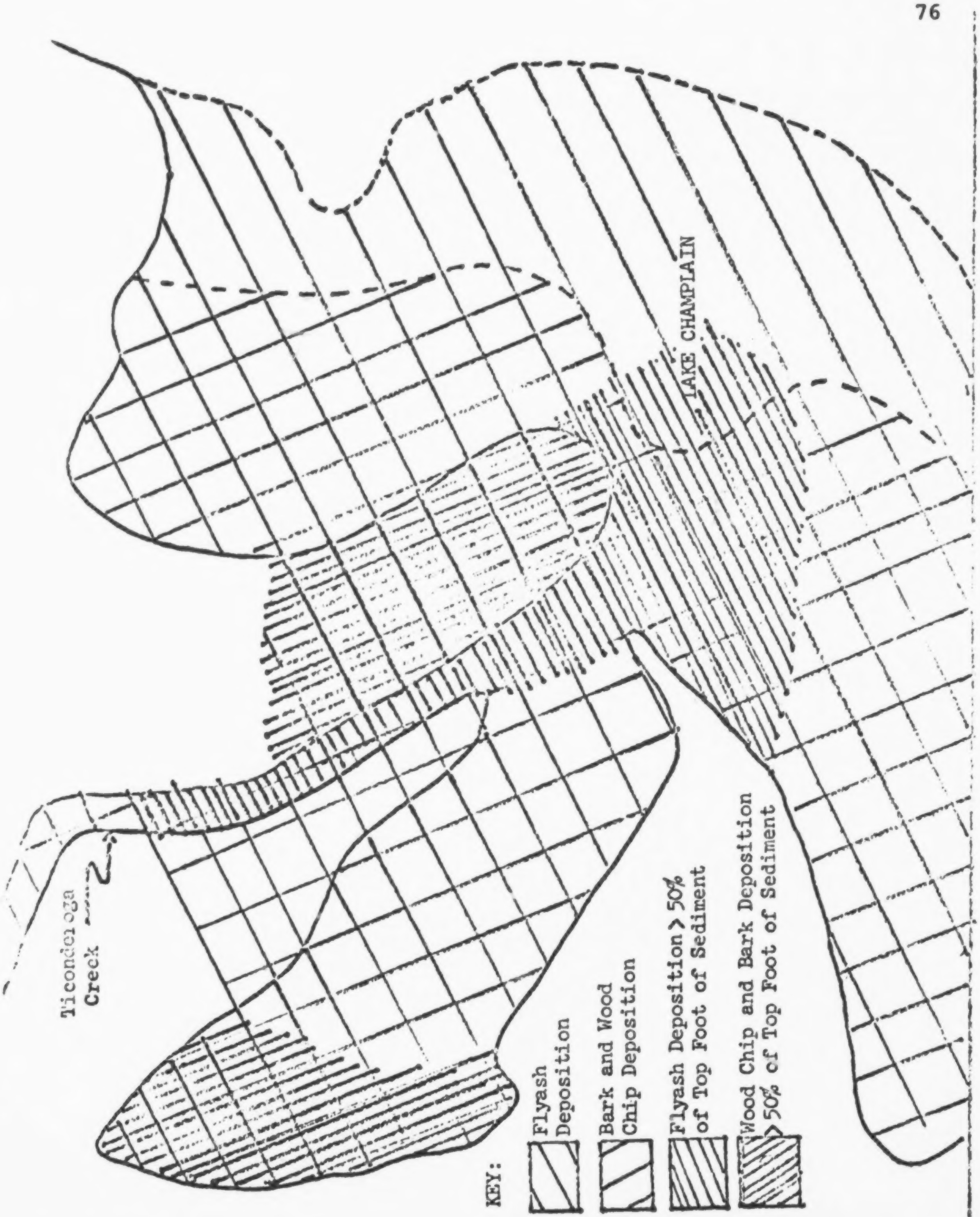

N
Ticonderoga Creek
LAKE CHAMPLAIN
1
2
3
4
6
7
8
8A
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
28A
29
30
31
32
33
35
35A
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54

STATION LOCATIONS - TICONDEROGA SURVEY

FIG


N
S-1
S-2
S-3
S-4
S-5
Rt. 22
S-6
S-7
S-8
S-9
S-10
S-11
S-12
S-13
S-14
KEY:
Flyash Deposition
Bark and Woodchip Deposition

Sample Station Locations Ticonderoga Creek Figure 1A


Ticonderoga Creek
LAKE CHAMPLAIN
KEY:
▨ Flyash Deposition
▨ Bark and Wood Chip Deposition
▨ Flyash Deposition > 50% of Top Foot of Sediment
▨ Wood Chip and Bark Deposition > 50% of Top Foot of Sediment

DEPOSITION AREAS - TICONDEROGA SURVEY
FIGURE 2

MR. BROMBERG: I will now summarize the contents of that report.

Analyses of the sludge samples were conducted for concentrations of carbon, nitrogen and titanium. Carbon, an indication of organic material, is present in sewage and cellulosic (paper mill) waste. Nitrogen, which serves as a nutrient for plant and animal growth as well as a user of oxygen during decomposition, is found predominantly in sewage and not in cellulosic waste. Titanium, used in paper-making operations as a whitener, is found in wastes from plants such as paper mills using titanium as a raw material. As a result of these analyses, it was concluded that:

1. As determined by chemical tests, organic carbon is present in the deposits in Ticonderoga Creek and Ticonderoga Bay.

2. The major source of pollution is the Ticonderoga Division of the International Paper Company in Ticonderoga, New York.

The findings of the U. S. Army Corps of Engineers study are contained in its report and an addendum entitled "Report on Survey of Sludge and Lake Bottom Deposits - Ticonderoga Creek and Lake Champlain - Ticonderoga, N.Y.," January 1970.

Mr. Chairman, I would also like to have this report in its entirety introduced into the record.

MR. STEIN: We are going to have a problem with this one, Mr. Bromberg.

One, the pictures you have in the report in their present form will not be reproduced and will just be a blur. And this will cost everyone a lot of money, and we won't get anything.

Secondly, you have these insert sheets. And that requires a hand insert. Is it possible to get these reduced to a single page?

MR. BROMBERG: We can see if that can be done.

MR. STEIN: Well, with those requirements -- and I hope they are readable -- but if we have to put in a hand insert, and I hope we can get better pictures, if you can accomplish that, we will let that appear in the record as if read. If not, I guess this report, at least the charts, will have to remain as an exhibit.

MR. BROMBERG: Thank you.

(The above-mentioned report follows.)

REPORT ON SURVEY OF SLUDGE AND LAKE BOTTOM DEPOSITS

TICONDEROGA CREEK AND LAKE CHAMPLAIN - TICONDEROGA, N. Y.

PREPARED FOR THE FEDERAL WATER POLLUTION
CONTROL ADMINISTRATION, NORTHEAST REGION

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT
CORPS OF ENGINEERS

JANUARY 1970

REPORT ON SURVEY OF SLUDGE AND BOTTOM DEPOSITS
TICONDEROGA CREEK AND LAKE CHAMPLAIN - TICONDEROGA, N.Y.

TABLE OF CONTENTS

Paragraph		Page
1.	Authority	1
2.	Project Location and Description	1
4.	Field Operations - Survey and Sampling	2
6.	Office Work	3
9.	Findings and Discussion - Ticonderoga Creek	3
10.	Marsh Area	4
11.	Mouth of Ticonderoga Creek and Lake Champlain	4
16.	Disposal	5
17.	Upland Disposal	6
18.	Deep Water Disposal	6
20.	Cost Estimates	7
21.	Summary	7
22.	Conclusion	8

TABLES

Number		Page
1.	Summary of Estimated Costs	9

REPORT ON SURVEY OF SLUDGE AND BOTTOM DEPOSITS
TICONDEROGA CREEK AND LAKE CHAMPLAIN - TICONDEROGA, N.Y.

LIST OF FIGURES

Number	Title
1.	Vicinity Map
2.	Delineation of Characteristic Bottom Deposits
3.	Ticonderoga Creek and Lake Champlain - Drill Hole Locations and Soundings
4.	Ticonderoga Creek - Drill Hole Locations and Soundings
5.	Boring Logs and Ticonderoga Creek Cross Sections Drill Holes S1 to S3
6.	Boring Logs and Ticonderoga Creek Cross Sections Drill Holes S4 to S8
7.	Boring Logs and Ticonderoga Creek Cross Sections Drill Holes S9 to S14
8.	Boring Logs and Ticonderoga Creek Cross Sections Drill Holes A to C & 1A
9.	Boring Logs and Lake Bottom Cross Sections Drill Holes 1 to 2
10.	Boring Logs and Lake Bottom Cross Sections Drill Holes 3 to 4
11.	Boring Logs and Lake Bottom Cross Sections Drill Holes 6 to 12
12.	Boring Logs and Lake Bottom Cross Sections Drill Holes 13 to 20
13.	Boring Logs and Lake Bottom Cross Sections Drill Holes 21 to 27
14.	Boring Logs and Lake Bottom Cross Sections Drill Holes 28 to 33
15.	Boring Logs and Lake Bottom Cross Sections Drill Holes 35 to 41
16.	Boring Logs and Lake Bottom Cross Sections Drill Holes 42 to 48
17.	Boring Logs and Lake Bottom Cross Sections Drill Holes 49 to 54

REPORT ON SURVEY OF SLUDGE AND BOTTOM DEPOSITS
TICONDEROGA CREEK AND LAKE CHAMPLAIN - TICONDEROGA, N.Y.

LIST OF PHOTOS

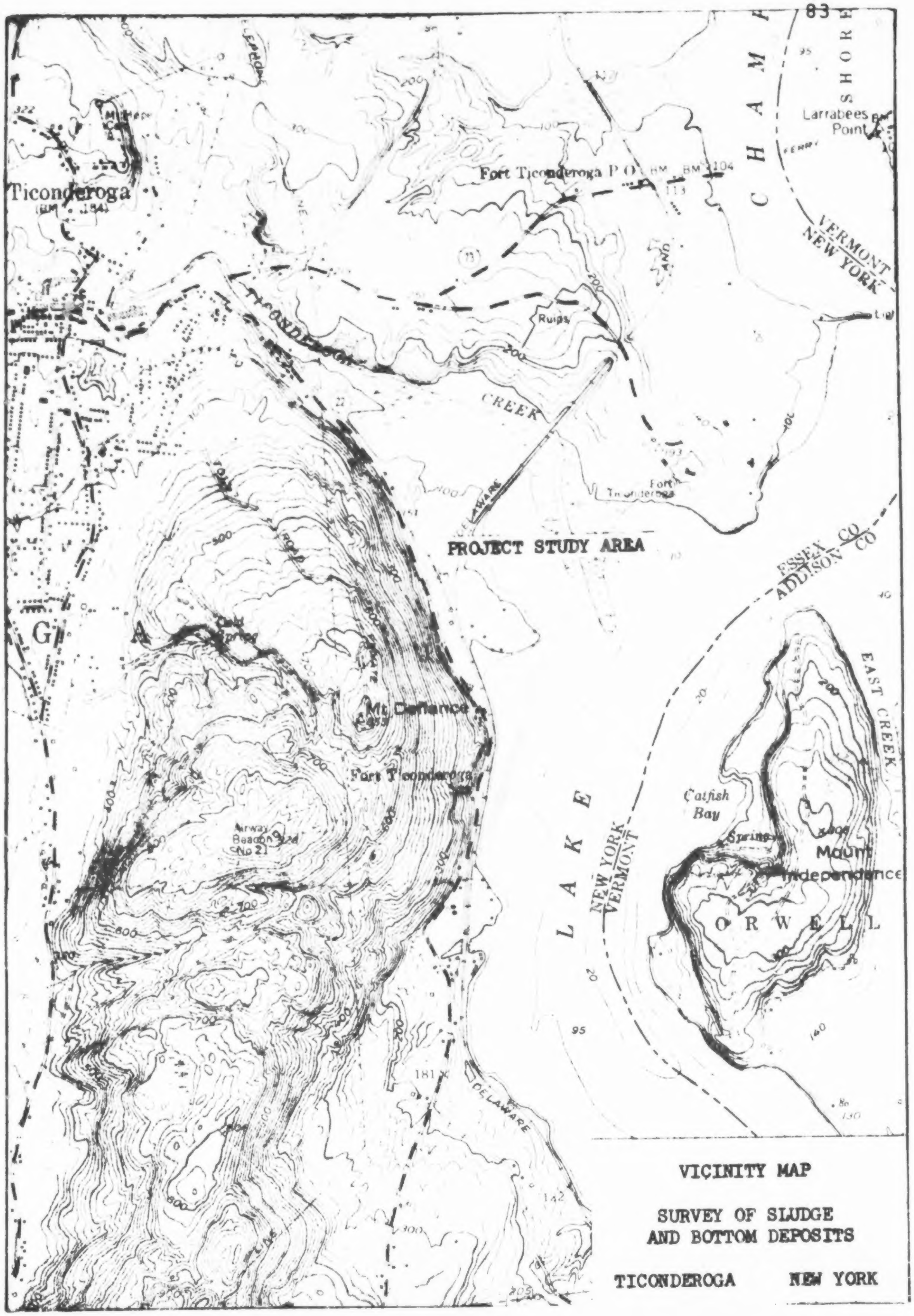
Number	Title
1.	Ticonderoga Creek Showing Railroad Bridge and Marsh Area
2.	Confluence of Ticonderoga Creek with Lake Champlain Showing Delta of Sludge Deposits
3.	Ticonderoga Creek Looking Downstream From Drill Hole S-3
4.	Ticonderoga Creek Looking Downstream From Bridge at Route 22
5.	Floating Rig Used For Explorations on Open Water
6.	Open Marsh Adjacent to Ticonderoga Creek and West of The Railroad Tracks
7.	Sampling Operation in Progress
8.	Removal of Sample From Sampler

APPENDICES

A. Cost Estimate - Upland Disposal
B. Cost Estimate - Deep Water Disposal

ATTACHMENTS

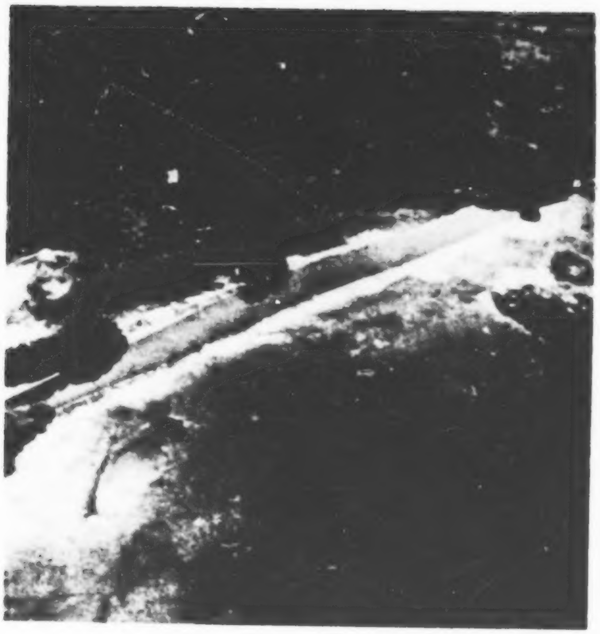
1. Letter of Request from FWPCA
2. Letter from New York State Conservation Department


Ticonderoga
BM 184
Fort Ticonderoga P.O.
BM 104
C H A M
S H O R E
Larrabees Point
FERRY
VERMONT
NEW YORK
TICONDEROGA
CREEK
Ruins
Fort Ticonderoga
DELAWARE
PROJECT STUDY AREA
ESSEX CO
ADDISON CO
G
A
Mt Defiance
Fort Ticonderoga
Airway Beacon No 21
L A K E
NEW YORK
VERMONT
Catfish Bay
Spring
Mount Independence
O R W E L L
EAST CREEK
DELAWARE

VICINITY MAP

SURVEY OF SLUDGE
AND BOTTOM DEPOSITS

TICONDEROGA NEW YORK



TICONDEROGA CREEK SHOWING RAILROAD BRIDGE AT RIGHT
AND MARSH AREA IN FOREGROUND

CONFLUENCE OF TICONDEROGA CREEK WITH LAKE CHAMPLAIN
SHOWING DELTA OF SLUDGE DEPOSITS

PHOTOS 1 AND 2

REPORT ON SURVEY OF SLUDGE AND BOTTOM DEPOSITS IN TICONDEROGA CREEK AND LAKE CHAMPLAIN - TOCONDEROGA,NEW YORK

1. AUTHORITY. This report was prepared at the request of the Regional Director, Northeast Region, Federal Water Pollution Control Administration. The Director, by letter to the Division Engineer dated 23 December 1968, requested the prosecution of a survey of sludge and bottom deposits in Ticonderoga Creek and Lake Champlain near the mouth of Ticonderoga Creek at Ticonderoga, New York, and a report thereon with recommendations as to suggested methods for removal of the deposits. A copy of the request letter is printed as Attachment 1. Prosecution of the survey and preparation of the report was carried out under provisions of ER 1140-2-302, dated 18 February 1966, and titled: "Performance of Work for Other Federal Agencies".

2. PROJECT LOCATION & DESCRIPTION. The project is located in Ticonderoga, New York along the New York-Vermont State Lines and on Lake Champlain. The site is approximately 250 miles north of New York City. Ticonderoga Creek flows as an outlet from Lake George, through the town of Ticonderoga, to Lake Champlain. There are five dams along Ticonderoga Creek between Lake George (elevation 319.0 ft. msl) and Lake Champlain (elevation 93.0 ft. msl) with no locks to permit vessel passage. There is no commercial and minimal recreational use of the creek. The study area includes Ticonderoga Creek from the International Paper Company mill just below the last falls to the confluence of the creek with Lake Champlain. Also included in the study is an area of approximately 200 arces of the bottom of Lake Champlain at the mouth of the creek. This area of Ticonderoga Creek and Lake Champlain has been polluted by wastes from pulping and paper making processes of the International Paper Company as well as raw sewage discharged by the Ticonderoga community. These wastes have resulted in a bottom covering of sludge and other associated deposits in the creek and lake. The purpose of this report is to define the areal extent and total volume of these deposits. Preliminary surveys performed by the FWPCA indicated the deposits in the lake extend a radius of approximately 600 yards from the mouth of the creek into the lake. Deposits exist in the creek up to the International Paper Company mill.

3. The upper portion of the creek study reach, from the mill to the new bridge at Route 22 may be described as narrow and steep sloped with the walls on the north coated with pulp and other wastes and having several sharp turns. Downstream of the Route 22 bridge to the Delaware and Hudson Railroad bridge, thick tree growth obstructs the banks of the creek. In this area is a triangular marshland bounded by Ticonderoga Creek, the Delaware and Hudson Railroad tracks and Route 22. South of the railroad bridge the creek runs for one-half mile between two spit-like marsh formations and empties into Lake Champlain at a delta composed of sludge deposits. To the west of the creek in this area is a shallow lagoon which is connected to the lake near the delta. The lake at the mouth of the creek is approximately 5 feet in depth and deepens radially to a maximum of 20-25 feet near the New York-Vermont State Line.

2 OF 4

PB

230753

1.0
4.5
5.0
5.6
6.3
7.1
8.0
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6

4. FIELD OPERATIONS-SURVEY AND SAMPLING. The field survey and bottom sampling operation was performed during the period 17 February to 21 March 1969 by representatives of the Troy Lock and Dam Office and the Foundations and Materials Branch of the New York District, Corps of Engineers. A baseline was established along the tracks of the Delaware and Hudson Railroad and subsequently tied into an assumed coordinate system. From this baseline a grid system was established south of the railroad on Lake Champlain. The survey was performed in the winter months to permit this grid system to be laid out on the ice of Lake Champlain and the locating of the test holes was greatly facilitated by using this method. The test holes were located at intervals of 500 feet on center. Soundings were taken at all holes to determine the elevation of the lake bottom. The elevations are correlated with the datum of Low Lake Level (93.0 ft. msl) and were tied in with USC&GS vertical control points in the area. The test holes in Ticonderoga Creek were taken at either 1/3 points across the creek or at the centerline and shorelines. The creek cross-sections were taken from the International Paper Company Plant to the Delaware and Hudson Railroad Bridge at intervals of approximately 1000 feet.

5. Fifty-six test holes were taken on the grid at the mouth of the creek and on Lake Champlain. Access to the lake bottom was gained by use of a gasoline engine powered ice auger. Samples were obtained by use of a torpedo type window sampler which has 2 collection windows 2 feet on center. In the sampling operation the torpedo is lowered, with the windows closed, to the desired depth. The drive rod is rotated to turn the inside cylinder thus permitting the opening of the windows. Additional rotation allows collection of the sample and reverse rotation will close the window so the sampler may be retrieved. Two fins extending from the sampler at the windows serve a dual purpose; they provide stability of the outside tube when the windows are opened and provide a means of pushing the sample into the chamber when the tube is rotated. Although samples were taken 2 feet on center, if doubt arose to the strata, samples were taken between these two foot centers. Because of the stream flow and temperature of the creek due to effluent from the International Paper Company, Ticonderoga Creek and a small area at the mouth of the creek remained open water and did not freeze. In these areas sampling was done from a boat with the same sampler mentioned previously. A total of 14 holes were taken in the creek. Three holes were placed in the swamplike area south of Ticonderoga Creek and west of the railroad tracks. An additional three holes were placed randomly on the Vermont shoreline in the vicinity of the Buoy 39 Marina, Catfish Bay and the protruding point north of Catfish Bay. Logs were made on the sampled material noting the type of material encountered and the consistency and depth of each stratum.These are presented in Figures 5 to 17. Material from each sample retained was sealed in plastic bags, frozen, and sent to the FWPCA Laboratory in Needham, Mass. for analysis and testing. During the course of the sampling operation the FWPCA, State of New York and State of Vermont had personnel present at various times for on-site inspections.

6. OFFICE WORK. An overall general plan on the scale 1"= 200' was developed showing the areal extent of the survey and location of the borings on the Lake Champlain grid and in Ticonderoga Creek. The logs were plotted and from the collected data cross-sections of the lake bottom and Ticonderoga Creek were developed. These cross-sections indicate the lake or creek bottom, extent of unnatural deposits and delineation of natural bottom material. The logs and the cross-sections were printed on the same sheets. The general plan of the Lake Champlain grid system (Figure 4) shows the shoreline at the time of the survey. At this time the water elevation was 95.0 ft. msl or 2 feet above Low Lake Level, the datum used to corrulate the elevations.

7. Pictures taken during the survey along with two aerial photographs are included in the report.

8. A quantity take-off was performed to determine the various amounts of the sludge material, with separate quantities developed for the different types of deposits found. The volume of sludge was determined by finding the area by use of a planimeter and multiplying by the average depth of sludge over the area. A separate plan (Figure 2) has been prepared to show the location of the various types of material found in the survey.

9. FINDINGS AND DISCUSSION-TICONDEROGA CREEK. As can be seen from the boring logs, the streambed of Ticonderoga Creek contains basically the same material from the International Paper Company mill to the Delaware and Hudson Railroad bridge, or the entire length of the study reach. This material can best be described as a mixture of cinders or fly-ash with some pieces of wood, brick, glass and gravel. The granular range of the cinders and fly-ash ran from a medium sand to a coarse gravel and most samples were graded to include an even distribution of these grain sizes. There is very little fine material such as silt or fine sand along the stream bed for the length of the creek. This lack of fines can be attributed to the velocity of Ticonderoga Creek being of sufficient magnitude to scour this material and leave only the coarser particles in place. Difficulty was encountered in obtaining samples of this material at depths below 3 feet due to the compact nature of the cinders. When the sampler could not be driven any further, probings were taken with a ½ inch rod to find the extent of the deposits. Towards the lower reach of the creek, where it widens and the velocity lessens, there were found along the shoreline deposits of 1 to 2 feet in depth of finer cinderlike material mixed with a black organic silt. Borings on the creek banks between the bridge at Route 22 and the Delaware and Hudson Railroad bridge show a layer of wood chips mixed with silt below the surficial covering of black organic silt. This layer is from one to two feet in thickness and lies directly above the natural bottom of soft brown cohesive silt and clay. The estimated quantity of cinders, organic silt and wood chips in Ticonderoga Creek is 77,000 cubic yards.

10. MARSH AREA. The marsh area adjacent to Ticonderoga Creek and also bordered by Route 22 and the railroad bridge has an average elevation of 93.0 msl and during the survey was under 1 foot of water. Drill holes A, B, and C were placed in this marsh. The overlying material is a brown and black slightly organic silt with some wood chips. Under this is a uniform layer of wood chips with a little silt having an average depth of 2.5 feet. This corresponds to the similar layer along the banks of Ticonderoga Creek and is surely an extension of it. The amount of material in this marsh above the natural bottom of a soft brown cohesive fibrous silt and clay is 260,000 cubic yards.

11. MOUTH OF TICONDEROGA CREEK AND LAKE CHAMPLAIN. From the Delaware and Hudson Railroad bridge to the confluence of the creek with Lake Champlain at the delta, the creek bottom remains primarily cinders and coarse material. There is however, a covering on the bottom of a soft grey or black organic muck with the cinders. Alongside the creek, the two marsh spits are composed of a surface covering of reeds, roots and fibrous organic silt. It is under this covering where two zones of deposits coincide. The black organic sludge from the creek joins the deposits of fibrous silt and wood chips which lie to either side of the spits. They are sometimes mixed together and sometimes separated into alternating strata. To the west of the creek in this length lies open water with an average depth of 1 foot below Low Lake Level or elevation 92.0 msl. Under a top layer of fibrous mat there is an almost consistant strata of 1 to 3 feet of wood chips. They are of the same size (1/8" square) as those found in the marsh area. The in-situ condition is loose and watery with little if any silt. In some cases traces of these wood chips were found in the natural bottom of soft and coheisve fibrous silt and clay. This type of material was also found to the east of the creek from the bridge to the delta. The total volume of the deposits of wood chips and overlying fibrous mat south of the railroad bridge is 350,000 cubic yards.

12. The delta and surrounding area at the mouth of the creek is composed primarily of a finely ground fly-ash. Beyond the delta and out into the lake or a radial distance of 1000 feet lies a combination of this fly-ash and the black organic silt. The total volume of the cinders, ground fly-ash and black organic silt from the railroad bridge through the creek and delta and on the lake bottom is 630,000 cubic yards.

13. To the south of Fort Ticonderoga and east of the creek, the lake bottom has a surficial covering of a soft and cohesive, brown and black organic fibrous silt. These deposits vary in depth from 3.0 feet near the end of the creek to 0.5 feet just below Fort Ticonderoga. The total estimated volume of this characteristic deposit is 140,000 cubic yards.

14. On the outlying area in the vicinity of the New York-Vermont border lies a surface covering of a slightly organic silt and clay over the natural blue-grey clay bottom. This deposit is usually not more than one foot deep and visual inspection shows black areas which are apparently undergoing decomposition. Whether this decompostion is natural or due to pollutants will be determined by laboratory analysis. There are 32,000 yards of this type of material.

15. The three test holes placed on the Vermont shoreline show some traces of deposition, particularly the hole DH-56, placed near Catfish Bay. There was present in this area approximately one-half foot of a soft grey-black silt with a few wood chips. The other two borings, DH-55 and DH-57 showed no visible signs of pollution or decompostion. The limits of the project prevented further exploration on the Vermont shoreline.

16. DISPOSAL. The matter of removing sludge and other deposits from Ticonderoga Creek and Lake Champlain has been investigated. Several methods are possible but only two have been found to be feasable. The most economically desireable method of disposing of the accumulated material would be spoiling in the immediate vicinity of the sludge at lake level. The two areas considered for this were the marsh area adjacent to Ticonderoga Creek and the Delaware and Hudson Railroad and another swamp area which is 1 mile north of Fort Ticonderoga and borders on Lake Champlain. The area north of Fort Ticonderoga would not be made available for spoil disposal purposes according to the owner of the land. If the area adjacent to Ticonderoga Creek was used for spoil disposal it would be necessary to construct approximately 3500 linear feet of earth dike to an elevation 14 feet above the existing level of the marsh. Soil conditions are such along the creek that a dike of this magnitude would prove to be unstable. Aside from the creek embankment stability problems involved there is considerable opposition to use of this land for spoiling from the New York State Conservation Department, Division of Fish and Game. The objection of this agency stems from their view that this marsh area is productive of waterfowl and fish. The letter stating the opposition of the State Conservation Department is printed as Attachment II. Other plans considered for the removal of the sludge included dredging and pumping the material to a basin for drying and then loading onto trucks for removal and final deposition at an upland spoil area. This plan was eliminated due to the fact that no drying basin large enough was found. A large basin is necessary due to the length of time required for drying of the fine grained silts and clays which constitute the major portion of the material. If the dredged material were to be placed in a smaller basin and rehandled and trucked out while still wet, it would necessitate the use of 25 trucks alone working a 10 hour day to keep the material moving. Incineration has also been considered because of the large

amount of fibrous material involved. The bulk of all this type of material encountered, however, lies in the area of the Ticonderoga Creek marsh and the lagoon south of the Delaware and Hudson Railroad tracks. This area was not considered for spoil disposal because of objections from the State Conservation Department, therefore it will not be considered for dredging and removal of the fibrous material. Since the material remaining to be dredged is primarily cinders or silt and clay it would be unfeasable to consider incineration for this type of material alone. With the above plans eliminated there remains two plans for the disposal of the sludge which may be implemented. They are dredging and pumping the sludge to an upland area or disposal of the sludge in the deep waters of Lake Champlain.

17. UPLAND DISPOSAL. The major obstacle to disposal of the sludge and other deposits that have accumulated in Ticonderoga Creek and Lake Champlain is the finding of an area large enough to accommodate the spoiled material. Since no area is available at lake level, which is most desirable from the dredging and pumping standpoint, the spoil material will have to be pumped to a higher elevation. The nearest available spoil area is a gully which lies north of the Mount Hope Cemetery and adjacent to Route 22. This gully can adequately accommodate the volume of material to be removed from the creek and lake bottom. The sludge and bottom deposits will be removed by means of a hydraulic dredge and pumped to the gully by pipeline. All the material in the lake bottom and the creek on the lake side of the railroad bridge will be removed by means of the hydraulic dredge. All the deposits in the creek north of the railroad bridge will be removed by means of a portable hydraulic dredge since the railroad bridge will not permit passage into the creek of the dredge used in the lake. Because of the distance the dredged material has to be pumped (approximately 2 miles from the railroad bridge to a gully spoil area) and the rise in elevation of 130 feet to the gully it will be necessary to incorporate 2 booster units in the pipeline. This will assure enough power to transport the material from the lake to the gully spoil area.

18. DEEP WATER DISPOSAL. The alternative plan considered in lieu of upland disposal is disposal of the material in the deep waters of Lake Champlain. In accomplishing the work by clamshell dredge, the deposited material would be transported in scows to an area in Lake Champlain located 20 statute miles from the dredging site and then deposited in depths of water not less than 150 feet. There is an increased amount of yardage to be removed by this method to provide for floatation of the scow. It is assumed that the scow would need a channel 40 feet wide and that these channels would be 160 feet center to center. The intervening areas would be dredged to a depth necessary to remove the deposits only, i.e. not for floatation of the scow. Dredging of Ticonderoga Creek cannot be accomplished by a clamshell rig and scow because of the obstruction of the railroad bridge. It will therefore be necessary to assemble a portable hydraulic dredge to clear the creek. This material can then be deposited beyond the

railroad bridge and from this point loaded into scows to be transported to the dumping area. The work would be accomplished over a three year periods with the dredge working for 7 month period each year. The volume to be removed will be 1,230,000 cubic yards including the material in the creek plus an additional 250,000 cubic yards adjustment for dredging on fixed planes and 920,000 cubic yards for floating of the scow in 40 foot wide channels. Thus the total volume to be removed will be 2,400,000 cubic yards. This plan excludes removal of fibrous material and wood chips from the Ticonderoga Creek marsh due to objections from the State Conservation Department.

19. The implementation of this plan will depend on further testing to determine the colloidal suspension properties of the deposits to be dredged. Consideration must be given to the possibility of the lake clouding during the dumping process. Also to be considered is the possibility of any adverse effect on the nutrient balance of the lake due to this deep water disposal.

20. COST ESTIMATES. Estimates were prepared of the costs of removing the sludge and bottom deposits in accordance with the above suggested plans for upland disposal and disposal in the deep waters of Lake Champlain. The items given consideration in the evaluation of the costs were mobilization and demobilization, operation of the dredge and associated equipment, labor costs and contractor's field engineering and supervision. An additional 15% contingency cost was added to include supervision and administration costs along with engineering and design. The cost estimate was based on current unit costs for similar work in this area. A summary of the estimated costs is given in Table 1.

21. SUMMARY. The survey has found that there are 1,430,000 cubic yards of sludge, wood chips, cinders and other organic deposits in Ticonderoga Creek and Lake Champlain. These deposits range from one-half to 12 feet in depth and characteristic deposits are clearly delineated in certain areas. Ticonderoga Creek contains cinders and fly ash to depths of 8 feet. The marsh areas adjacent to Ticonderoga Creek contain deposits of wood chips and sawdust loosely consolidated and mixed with silt and marsh vegetation. These deposits range in depths to 4 feet. At the mouth of Ticonderoga Creek and extending radially outward into Lake Champlain lie accumulations of a black sludge mixed with fly-ash. On the outer limits of the area surveyed the lake bottom consists of a silt and clay showing definite organic decomposition.

This report has considered methods for removal and disposal of the accumulated material and presents a discussion of two methods of accomplishi this work with associated cost estimated for both plans. The costs are summarized in Table 1.

22. CONCLUSION. Under the authority of Section 219 of the Flood Control Act of 1965, Public Law 89 - 298, 89th Congress, the Chief of Engineers can accept orders for work or services from the Federal Water Pollution Control Administration and may perform all or any part of such work or services by contract. The New York District can perform the work as described in this report. If such a request is made to the Corps of Engineers it will be necessary for the FWPCA to provide the funding and obtain clearance from the Bureau of the Budget for implementation of the work.

TABLE 1

SUMMARY OF ESTIMATES AND COSTS

REMOVAL AND DISPOSAL OF DEPOSITS
TICONDEROGA CREEK AND LAKE CHAMPLAIN - TICONDEROGA N.Y.

UPLAND DISPOSAL	$4,400,000
DEEP WATER DISPOSAL	$3,700,000

TICONDEROGA CREEK LOOKING
DOWNSTREAM FROM DRILL HOLE S-3

TICONDEROGA CREEK LOOKING
DOWNSTREAM FROM THE BRIDGE
AT ROUTE 22

PHOTOS 3 AND 4

FLOATING RIG USED FOR EXPLORATIONS ON OPEN WATER

OPEN MARSH ADJACENT TO TICONDEROGA CREEK AND WEST OF THE RAILROAD TRACKS

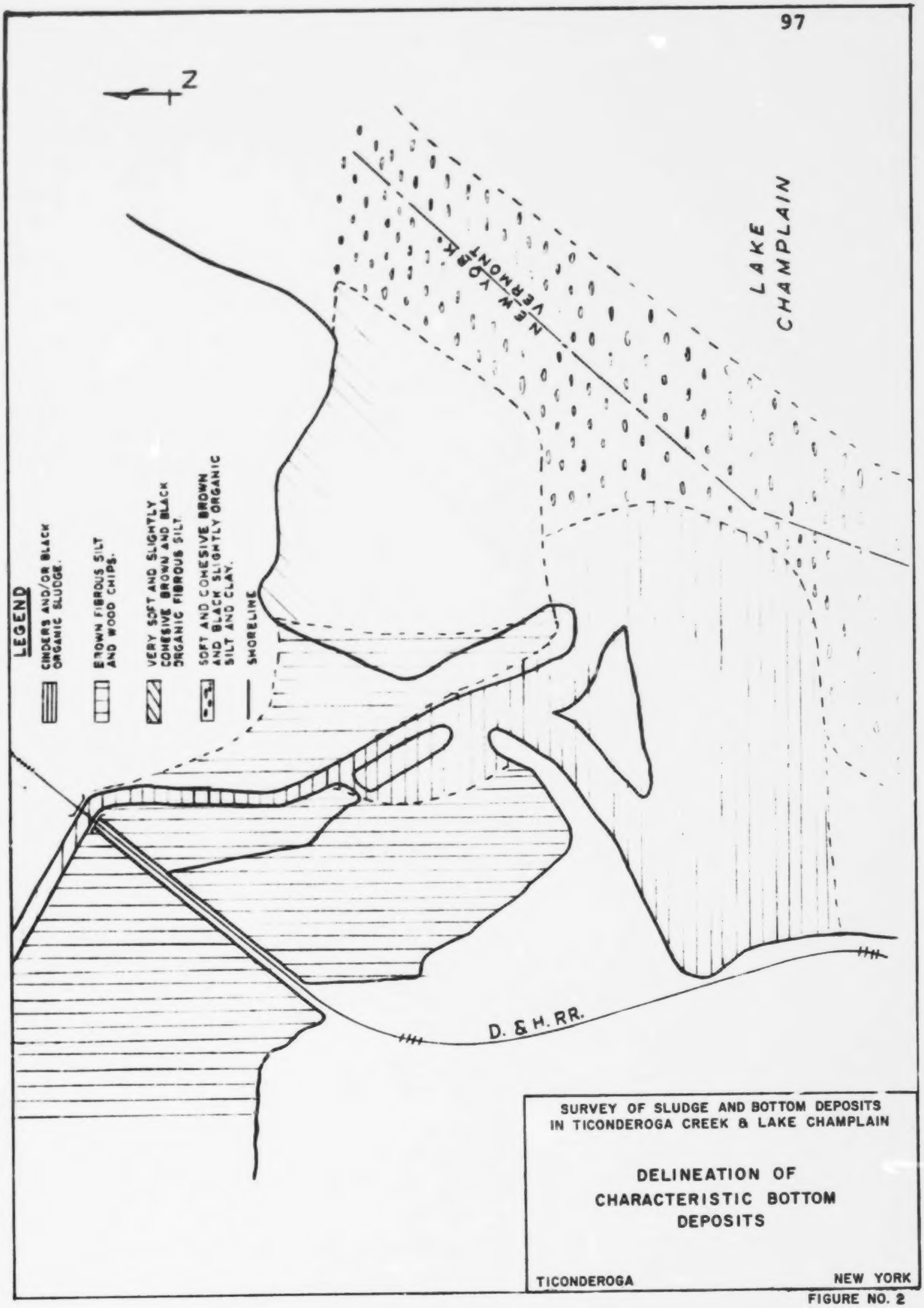
PHOTOS 5 AND 6

SAMPLING OPERATION
IN PROGRESS

Reproduced from
best available copy.

REMOVAL OF SAMPLE
FROM SAMPLER

PHOTOS 7 AND 8


N
LEGEND
CINDERS AND/OR BLACK ORGANIC SLUDGE.
BROWN FIBROUS SILT AND WOOD CHIPS.
VERY SOFT AND SLIGHTLY COHESIVE BROWN AND BLACK ORGANIC FIBROUS SILT.
SOFT AND COHESIVE BROWN AND BLACK SLIGHTLY ORGANIC SILT AND CLAY.
SHORELINE
NEW YORK
VERMONT
LAKE CHAMPLAIN
D. & H. RR.

SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

DELINEATION OF
CHARACTERISTIC BOTTOM
DEPOSITS

TICONDEROGA NEW YORK

FIGURE NO. 2

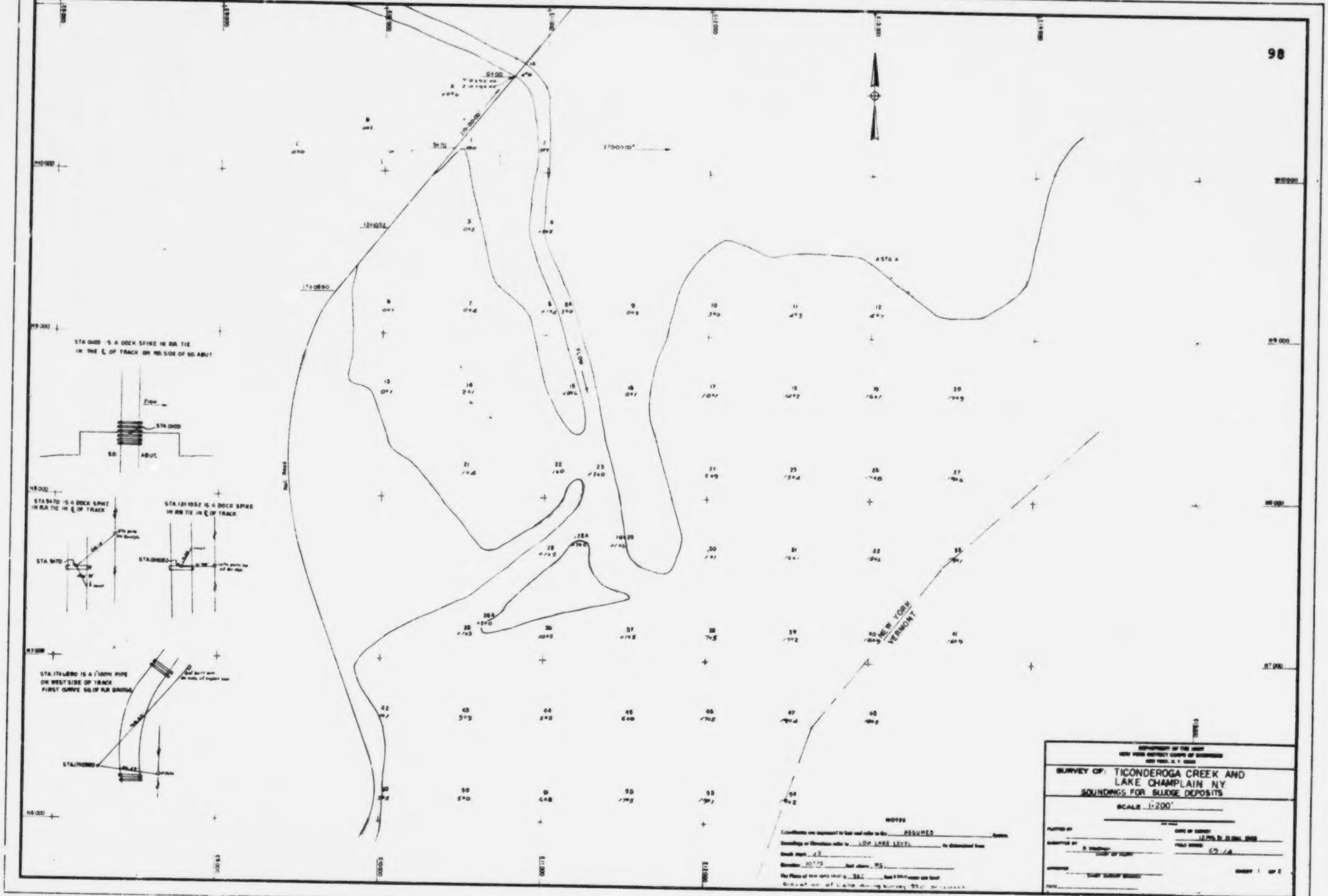

STA 0+00 IS A DOCK SPIKE IN RR TIE IN THE ℄ OF TRACK ON NO. SIDE OF SO. ABUT.
STA 9+70 IS A DOCK SPIKE IN RR TIE IN ℄ OF TRACK
STA 12+10.52 IS A DOCK SPIKE IN RR TIE IN ℄ OF TRACK
STA 17+08.90 IS A 1" IRON PIPE ON WEST SIDE OF TRACK FIRST CURVE SO. OF RR BRIDGE
ABUT.
FLOW
NEW YORK
VERMONT
Rail Road
NOTES
ASSUMED
LOW LAKE LEVEL
SURVEY OF: TICONDEROGA CREEK AND LAKE CHAMPLAIN NY
SOUNDINGS FOR SLUDGE DEPOSITS
SCALE 1:200'
SHEET 1 OF 2

FIGURE NO. 3

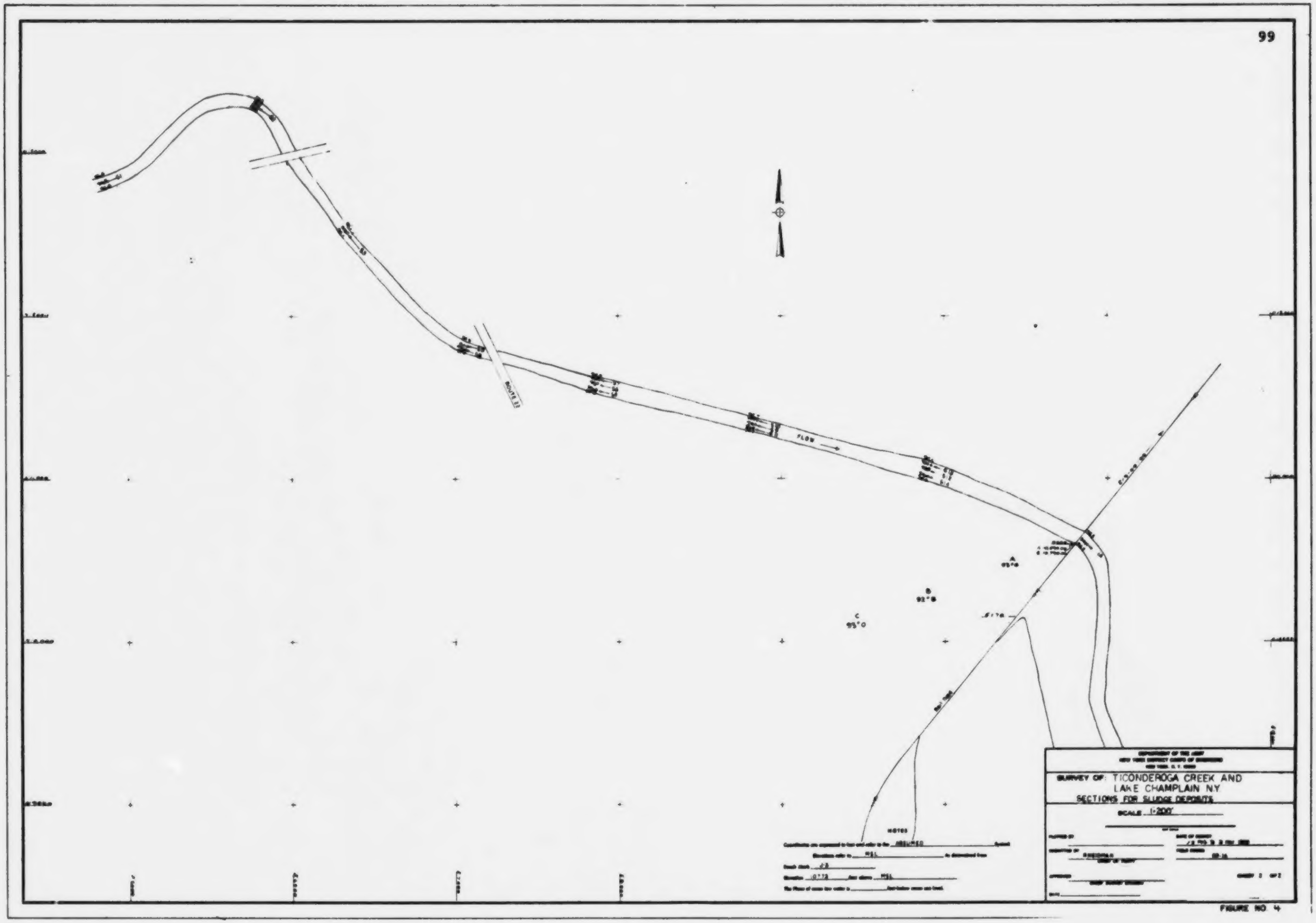
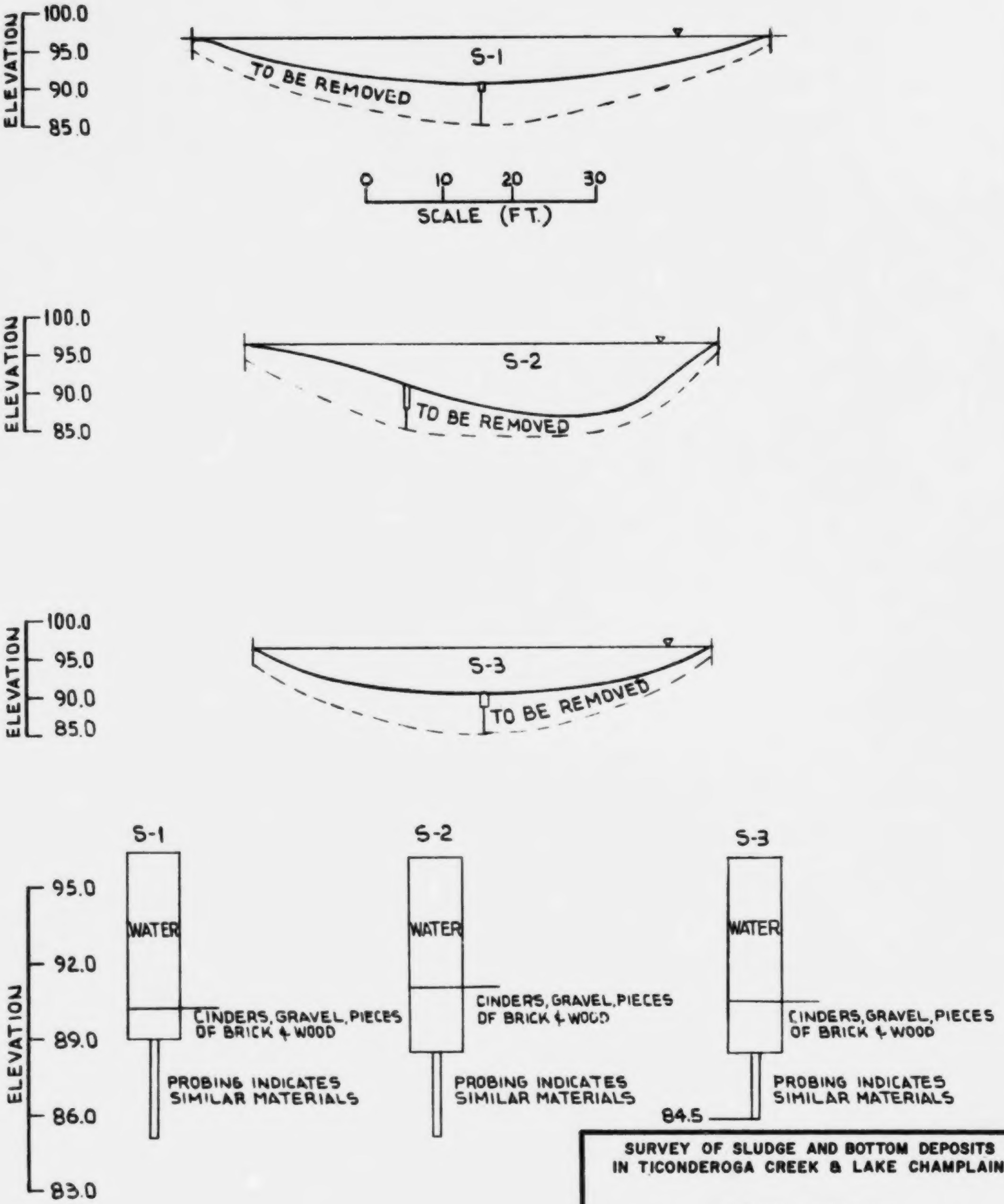

SURVEY OF: TICONDEROGA CREEK AND
LAKE CHAMPLAIN N.Y.
SECTIONS FOR SLUDGE DEPOSITS
SCALE 1:200'
NOTES
ASSUMED
MSL
FLOW
ROUTE 22
A
B
C
93.0
SHEET 1 OF 2

FIGURE NO. 4


ELEVATION
100.0
95.0
90.0
85.0
S-1
TO BE REMOVED
0
10
20
30
SCALE (FT.)
ELEVATION
100.0
95.0
90.0
85.0
S-2
TO BE REMOVED
ELEVATION
100.0
95.0
90.0
85.0
S-3
TO BE REMOVED
S-1
S-2
S-3
ELEVATION
95.0
92.0
89.0
86.0
83.0
WATER
WATER
WATER
CINDERS, GRAVEL, PIECES OF BRICK & WOOD
CINDERS, GRAVEL, PIECES OF BRICK & WOOD
CINDERS, GRAVEL, PIECES OF BRICK & WOOD
PROBING INDICATES SIMILAR MATERIALS
PROBING INDICATES SIMILAR MATERIALS
PROBING INDICATES SIMILAR MATERIALS
84.5

REFER TO FIG. 4 FOR BORING LOCATIONS

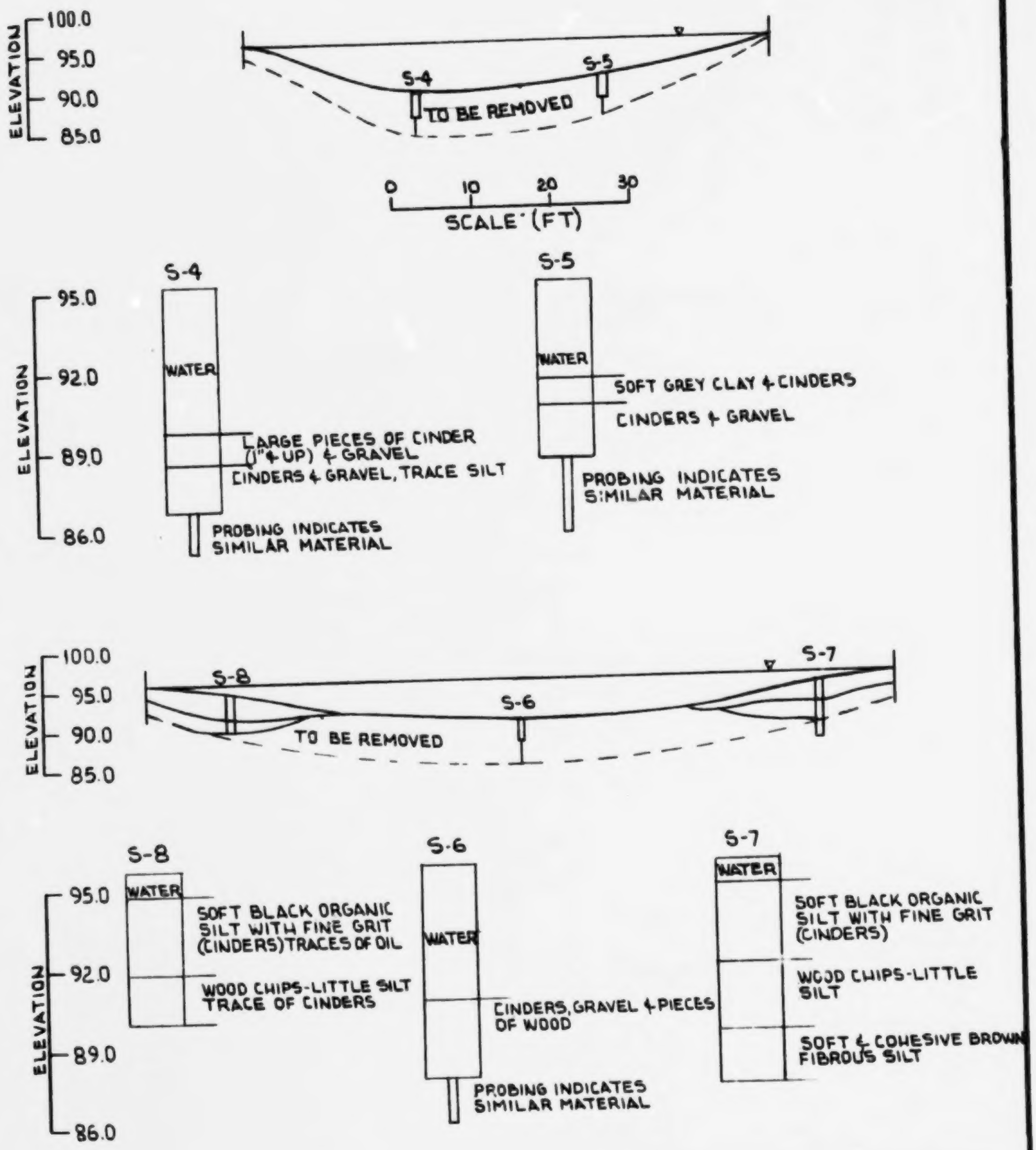
SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

BORING LOGS AND
TICONDEROGA CREEK CROSS SECTIONS

DRILL HOLES S1 TO S3

TICONDEROGA NEW YORK

FIGURE NO. 5


ELEVATION
100.0
95.0
90.0
85.0
S-4
S-5
TO BE REMOVED
0
10
20
30
SCALE (FT)
S-4
S-5
ELEVATION
95.0
92.0
89.0
86.0
WATER
LARGE PIECES OF CINDER (1" & UP) & GRAVEL
CINDERS & GRAVEL, TRACE SILT
PROBING INDICATES SIMILAR MATERIAL
WATER
SOFT GREY CLAY & CINDERS
CINDERS & GRAVEL
PROBING INDICATES SIMILAR MATERIAL
ELEVATION
100.0
95.0
90.0
85.0
S-8
S-6
S-7
TO BE REMOVED
S-8
S-6
S-7
ELEVATION
95.0
92.0
89.0
86.0
WATER
SOFT BLACK ORGANIC SILT WITH FINE GRIT (CINDERS) TRACES OF OIL
WOOD CHIPS-LITTLE SILT TRACE OF CINDERS
WATER
CINDERS, GRAVEL & PIECES OF WOOD
PROBING INDICATES SIMILAR MATERIAL
WATER
SOFT BLACK ORGANIC SILT WITH FINE GRIT (CINDERS)
WOOD CHIPS-LITTLE SILT
SOFT & COHESIVE BROWN FIBROUS SILT

REFER TO FIG. 4 FOR BORING LOCATIONS

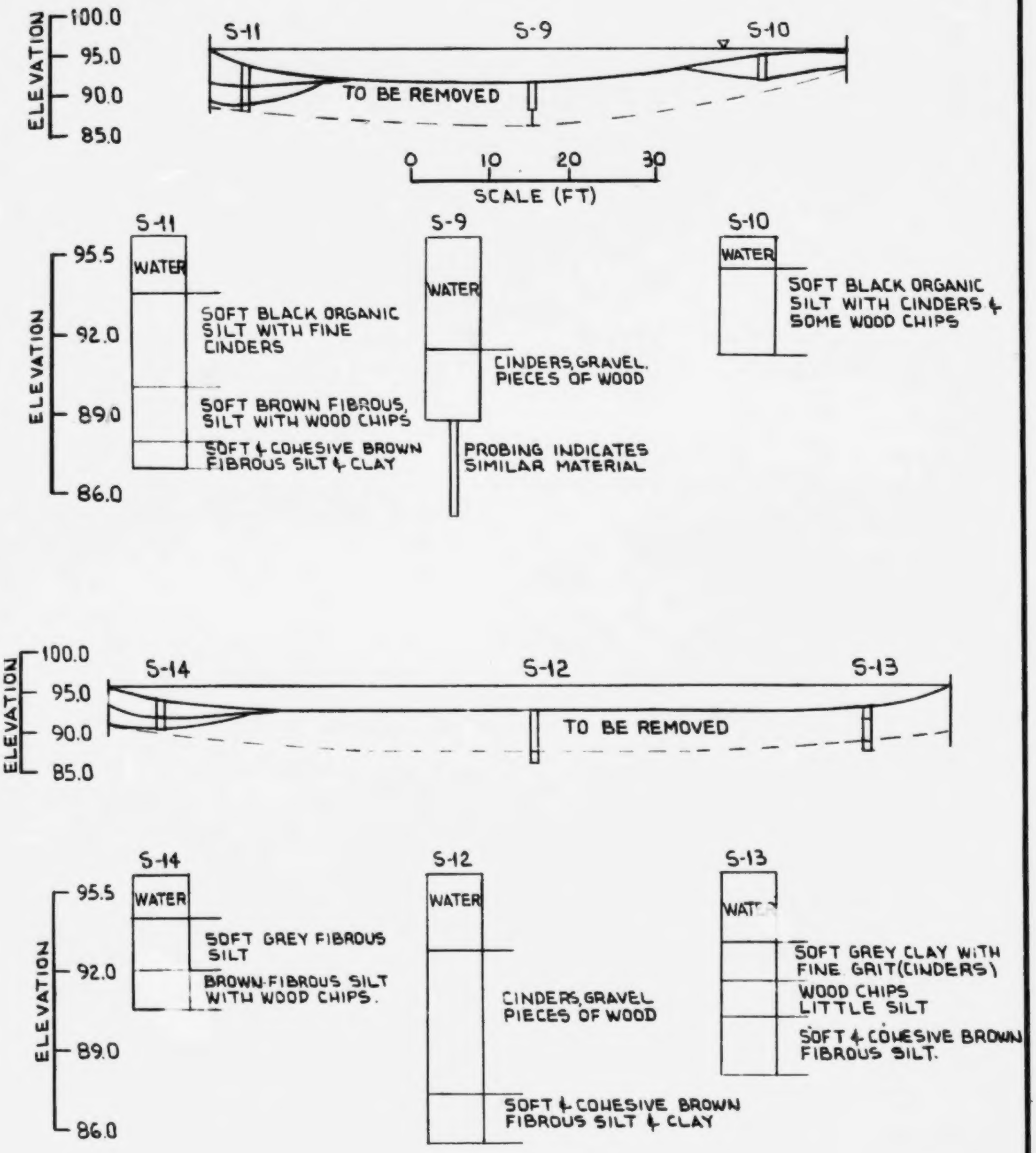
SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

BORING LOGS AND
TICONDEROGA CREEK CROSS SECTIONS

DRILL HOLES S4 TO S8

TICONDEROGA NEW YORK

FIGURE NO. 6


ELEVATION
100.0
95.0
90.0
85.0
S-11
S-9
S-10
TO BE REMOVED
0
10
20
30
SCALE (FT)
S-11
S-9
S-10
95.5
92.0
89.0
86.0
ELEVATION
WATER
SOFT BLACK ORGANIC SILT WITH FINE CINDERS
SOFT BROWN FIBROUS, SILT WITH WOOD CHIPS
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
WATER
CINDERS, GRAVEL, PIECES OF WOOD
PROBING INDICATES SIMILAR MATERIAL
WATER
SOFT BLACK ORGANIC SILT WITH CINDERS & SOME WOOD CHIPS
ELEVATION
100.0
95.0
90.0
85.0
S-14
S-12
S-13
TO BE REMOVED
S-14
S-12
S-13
95.5
92.0
89.0
86.0
ELEVATION
WATER
SOFT GREY FIBROUS SILT
BROWN FIBROUS SILT WITH WOOD CHIPS.
WATER
CINDERS, GRAVEL PIECES OF WOOD
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
WATER
SOFT GREY CLAY WITH FINE GRIT (CINDERS)
WOOD CHIPS LITTLE SILT
SOFT & COHESIVE BROWN FIBROUS SILT.

REFER TO FIG 4 FOR BORING LOCATIONS

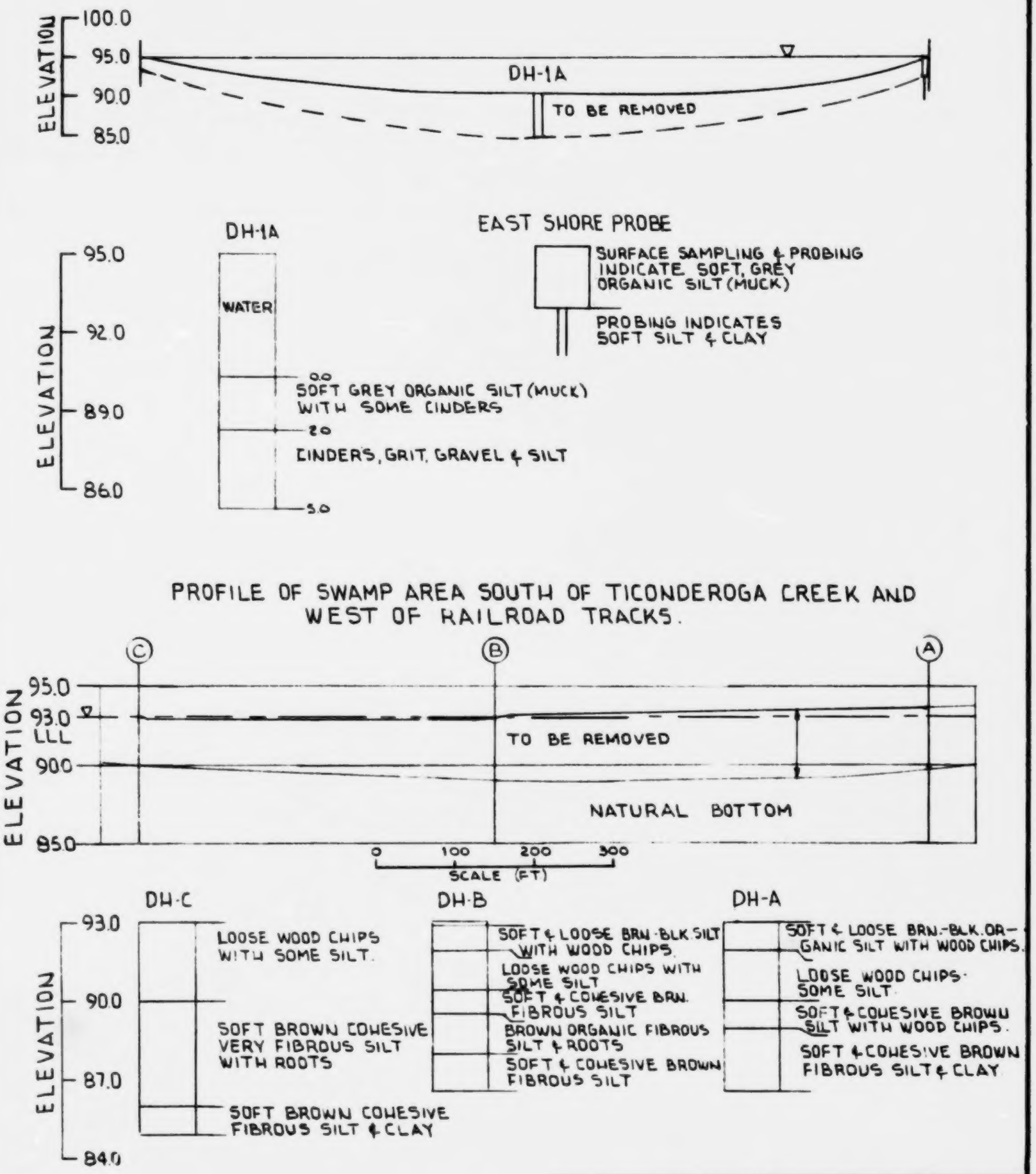
SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

BORING LOGS AND
TICONDEROGA CREEK CROSS SECTIONS

DRILL HOLES S9 TO S14

TICONDEROGA NEW YORK

FIGURE NO. 7


ELEVATION
100.0
95.0
90.0
85.0
DH-1A
TO BE REMOVED
DH-1A
EAST SHORE PROBE
SURFACE SAMPLING & PROBING INDICATE SOFT, GREY ORGANIC SILT (MUCK)
PROBING INDICATES SOFT SILT & CLAY
ELEVATION
95.0
92.0
89.0
86.0
WATER
0.0
SOFT GREY ORGANIC SILT (MUCK) WITH SOME CINDERS
2.0
CINDERS, GRIT, GRAVEL & SILT
5.0
PROFILE OF SWAMP AREA SOUTH OF TICONDEROGA CREEK AND WEST OF RAILROAD TRACKS.
C
B
A
ELEVATION
95.0
93.0
LLL
90.0
85.0
TO BE REMOVED
NATURAL BOTTOM
0
100
200
300
SCALE (FT)
DH-C
DH-B
DH-A
ELEVATION
93.0
90.0
87.0
84.0
LOOSE WOOD CHIPS WITH SOME SILT.
SOFT BROWN COHESIVE VERY FIBROUS SILT WITH ROOTS
SOFT BROWN COHESIVE FIBROUS SILT & CLAY
SOFT & LOOSE BRN-BLK SILT WITH WOOD CHIPS.
LOOSE WOOD CHIPS WITH SOME SILT
SOFT & COHESIVE BRN. FIBROUS SILT
BROWN ORGANIC FIBROUS SILT & ROOTS
SOFT & COHESIVE BROWN FIBROUS SILT
SOFT & LOOSE BRN.-BLK. ORGANIC SILT WITH WOOD CHIPS.
LOOSE WOOD CHIPS SOME SILT
SOFT & COHESIVE BROWN SILT WITH WOOD CHIPS.
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY

REFER TO FIG 4 FOR BORING LOCATIONS

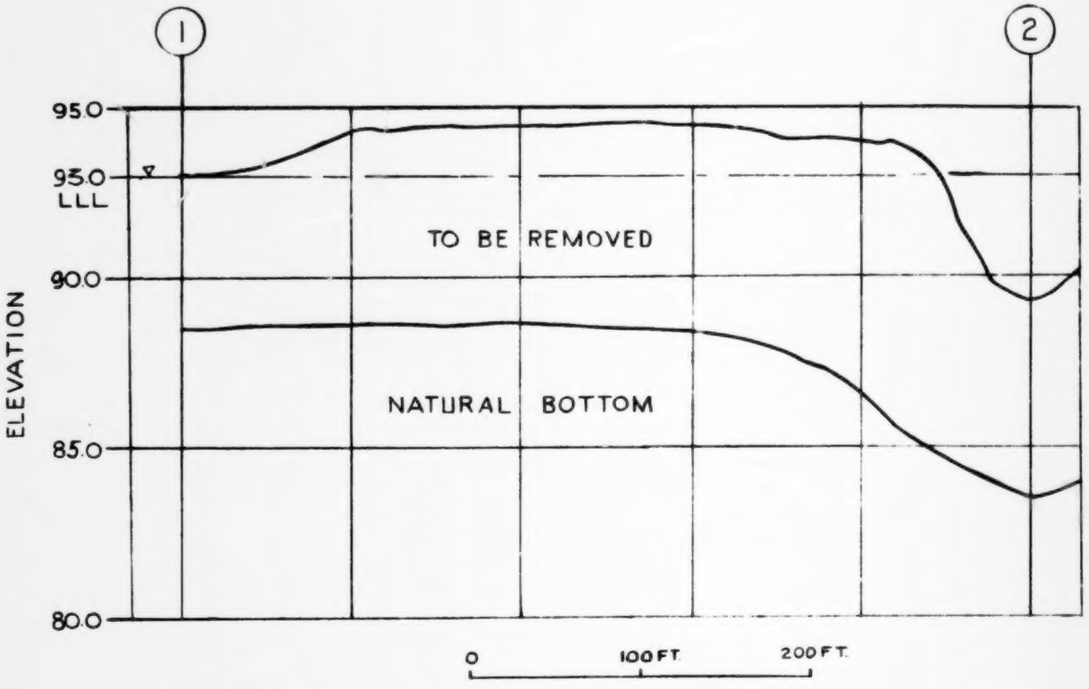
SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

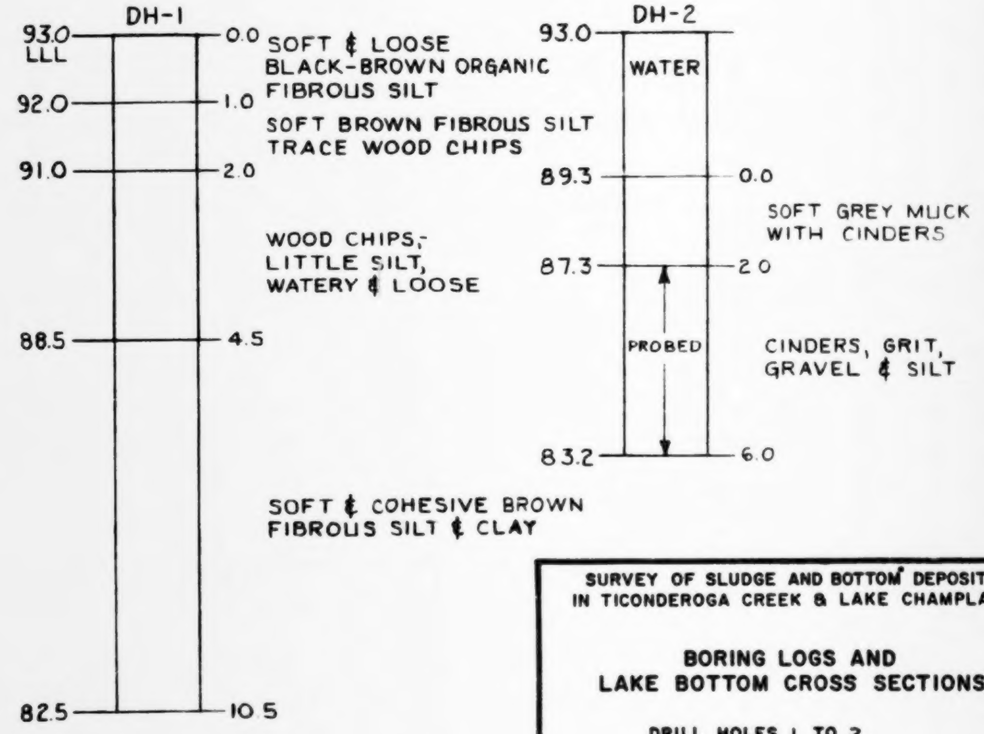
BORING LOGS AND
TICONDEROGA CREEK CROSS SECTIONS

DRILL HOLES A TO C & 1A

TICONDEROGA NEW YORK

FIGURE NO. 8




DH-1
93.0
LLL
92.0
91.0
88.5
82.5
0.0
1.0
2.0
4.5
10.5
SOFT & LOOSE
BLACK-BROWN ORGANIC
FIBROUS SILT
SOFT BROWN FIBROUS SILT
TRACE WOOD CHIPS
WOOD CHIPS,
LITTLE SILT,
WATERY & LOOSE
SOFT & COHESIVE BROWN
FIBROUS SILT & CLAY
DH-2
93.0
WATER
89.3
87.3
83.2
0.0
2.0
6.0
PROBED
SOFT GREY MUCK
WITH CINDERS
CINDERS, GRIT,
GRAVEL & SILT

REFER TO FIG. 3 FOR BORING LOCATIONS

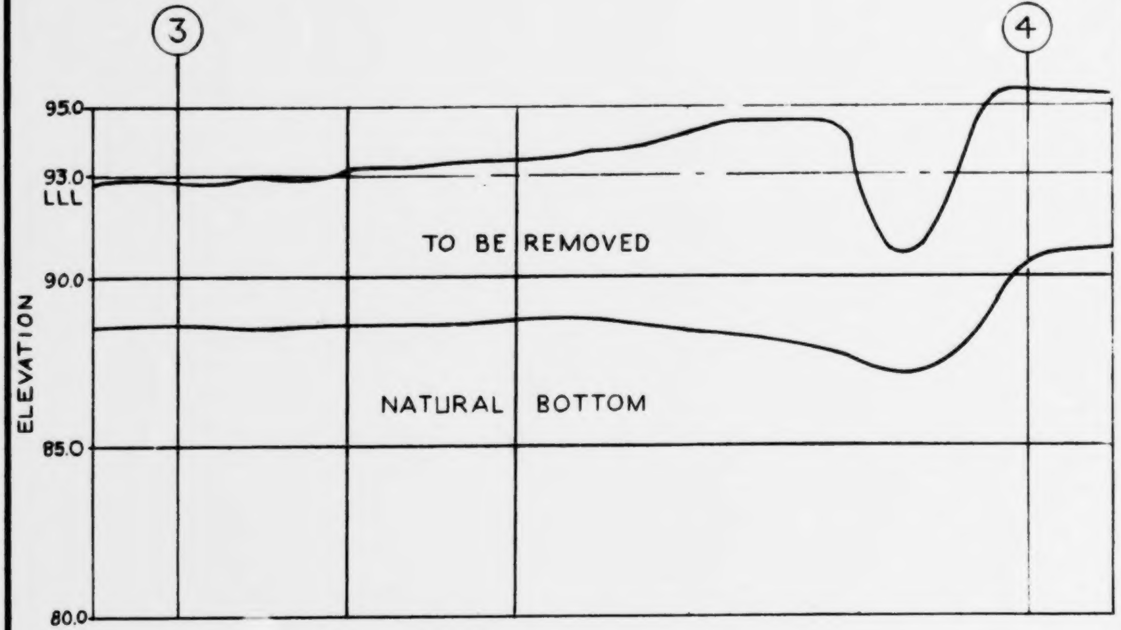
SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

**BORING LOGS AND
LAKE BOTTOM CROSS SECTIONS**

DRILL HOLES 1 TO 2

TICONDEROGA NEW YORK

FIGURE NO. 9



DH-3

93.0		WATER
92.8	0	
		SOFT & LOOSE DARK BROWN FIBROUS SILT WITH WOOD CHIPS
92.1	0.7	
		WOOD CHIPS, LITTLE SILT-WATERY & LOOSE
90.0	3.0	
		SOFT BROWN COHESIVE FIBROUS SILT & CLAY WITH WOOD CHIPS
88.5	4.5	
		SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
86.5	6.5	

DH-4

95.5	0	
		SOFT & LOOSE ORGANIC SILT WITH REEDS
94.5	1.0	
		SOFT SLIGHTLY COHESIVE GREY-BROWN FIBROUS SILT-SOME REEDS & WOOD CHIPS
90.5	5.0	
		SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
84.5	11.0	

REFER TO FIG 3 FOR BORING LOCATIONS

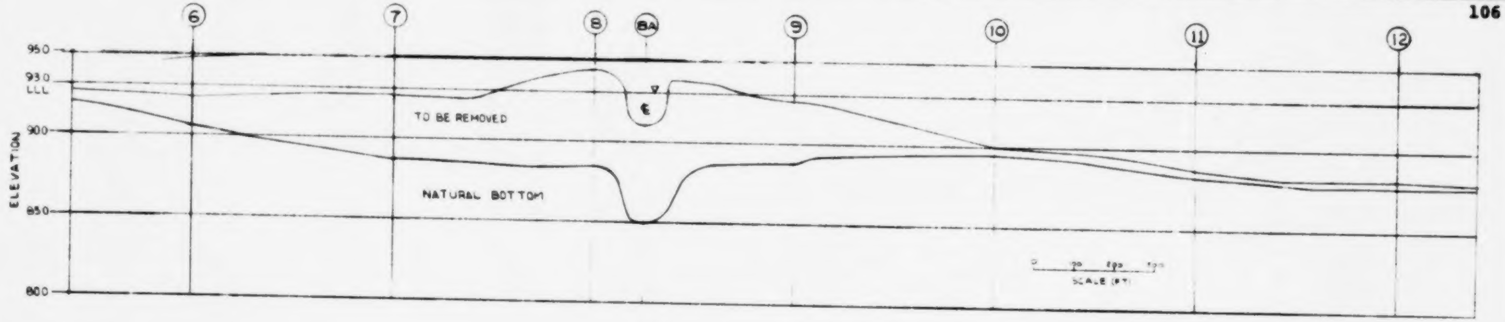
SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

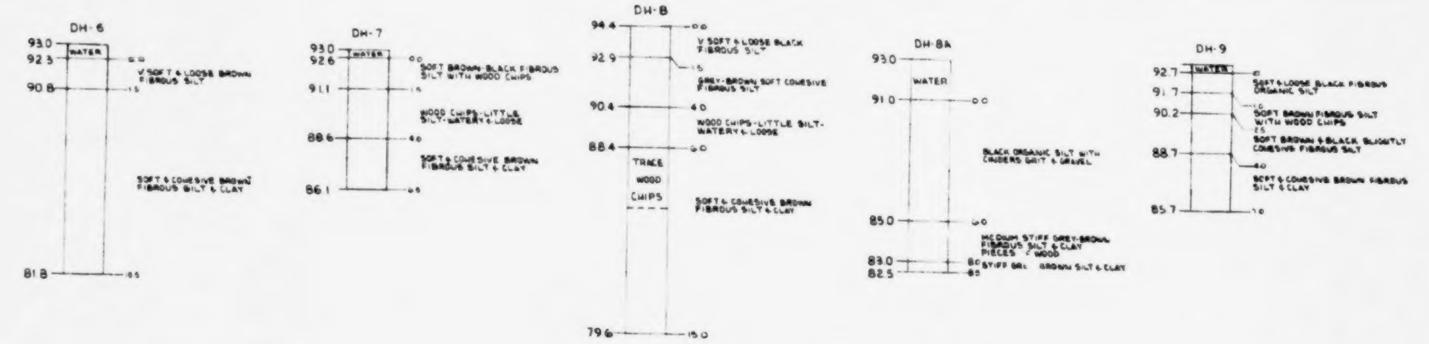
BORING LOGS AND
LAKE BOTTOM CROSS SECTIONS

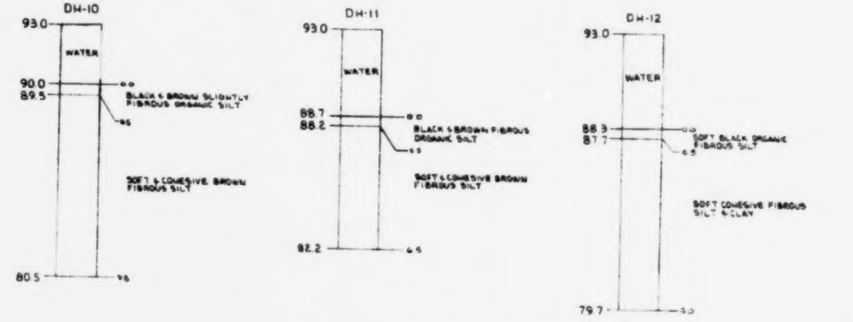
DRILL HOLES 3 TO 4

TICONDEROGA **NEW YORK**

FIGURE NO. 10


6
7
8
8A
9
10
11
12
95.0
93.0
LLL
90.0
85.0
80.0
ELEVATION
TO BE REMOVED
NATURAL BOTTOM
∇
℄
0 100 200 300
SCALE (FT)


DH-6
93.0
92.3
90.8
81.8
WATER
0.0
1.5
10.5
V SOFT & LOOSE BROWN FIBROUS SILT
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
DH-7
93.0
92.6
91.1
88.6
86.1
WATER
0.0
1.5
4.0
6.5
SOFT BROWN-BLACK FIBROUS SILT WITH WOOD CHIPS
WOOD CHIPS-LITTLE SILT-WATERY & LOOSE
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
DH-8
94.4
92.9
90.4
88.4
79.6
0.0
1.5
4.0
6.0
15.0
V SOFT & LOOSE BLACK FIBROUS SILT
GREY-BROWN SOFT COHESIVE FIBROUS SILT
WOOD CHIPS-LITTLE SILT-WATERY & LOOSE
TRACE WOOD CHIPS
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
DH-8A
93.0
91.0
85.0
83.0
82.5
WATER
0.0
6.0
8.0
8.5
BLACK ORGANIC SILT WITH CINDERS GRIT & GRAVEL
MEDIUM STIFF GREY-BROWN FIBROUS SILT & CLAY PIECES OF WOOD
STIFF GRL BROWN SILT & CLAY
DH-9
92.7
91.7
90.2
88.7
85.7
WATER
0
1.0
2.5
4.0
7.0
SOFT & LOOSE BLACK FIBROUS ORGANIC SILT
SOFT BROWN FIBROUS SILT WITH WOOD CHIPS
SOFT BROWN & BLACK SLIGHTLY COHESIVE FIBROUS SILT
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY


DH-10
93.0
90.0
89.5
80.5
WATER
0.0
.5
9.5
BLACK & BROWN SLIGHTLY FIBROUS ORGANIC SILT
SOFT & COHESIVE BROWN FIBROUS SILT
DH-11
93.0
88.7
88.2
82.2
WATER
0.0
0.5
6.5
BLACK & BROWN FIBROUS ORGANIC SILT
SOFT & COHESIVE BROWN FIBROUS SILT
DH-12
93.0
88.3
87.7
79.7
WATER
0.0
0.5
8.5
SOFT BLACK ORGANIC FIBROUS SILT
SOFT COHESIVE FIBROUS SILT & CLAY

REFER TO FIG 3 FOR BORING LOCATIONS

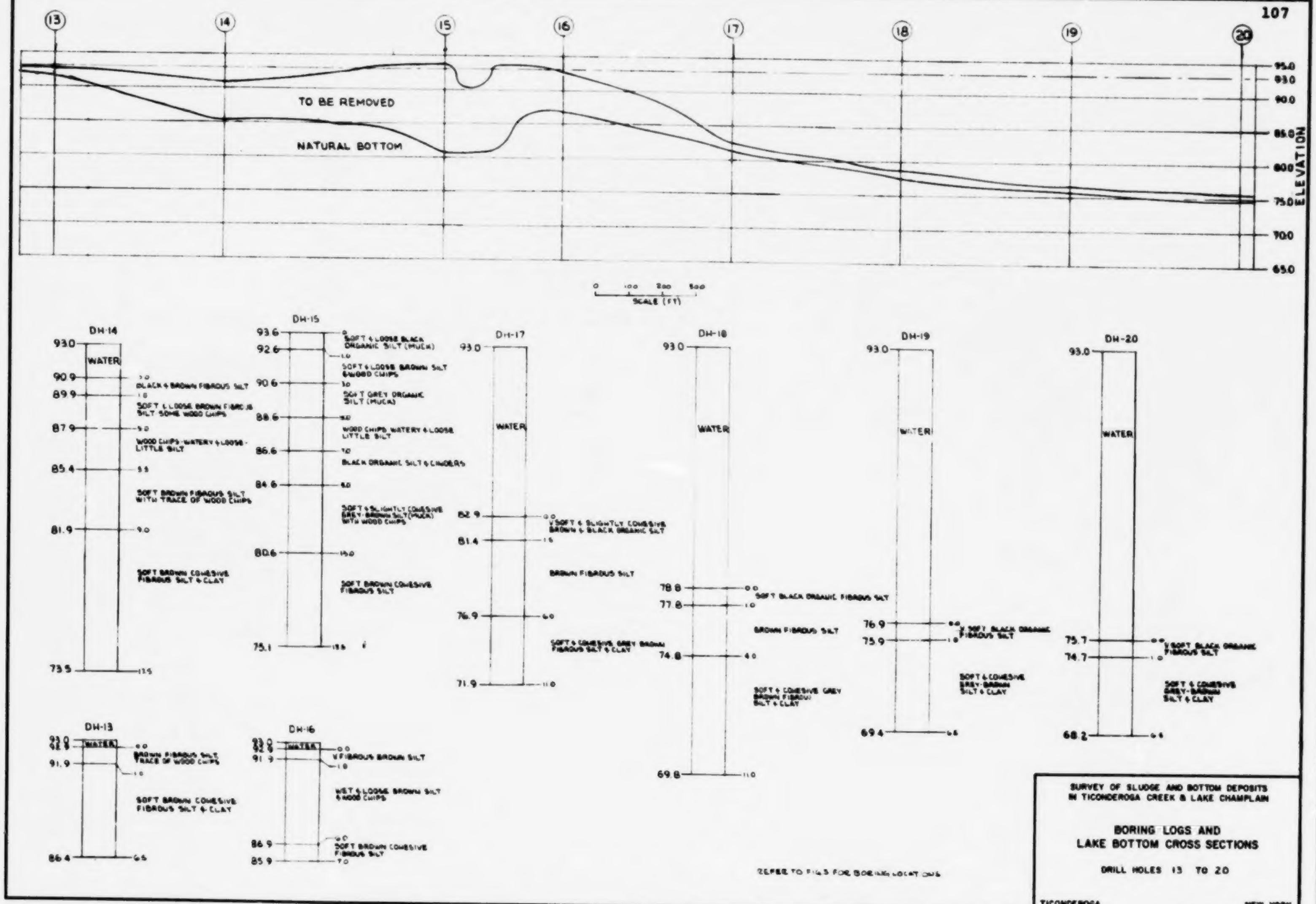
SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

BORING LOGS AND
LAKE BOTTOM CROSS SECTIONS

DRILL HOLES 6 TO 12

TICONDEROGA NEW YORK

FIGURE NO. 11


107
13
14
15
16
17
18
19
20
TO BE REMOVED
NATURAL BOTTOM
95.0
93.0
90.0
85.0
80.0
75.0
70.0
65.0
ELEVATION
0
100
200
300
SCALE (FT)
DH-14
93.0
WATER
90.9
2.0
BLACK & BROWN FIBROUS SILT
89.9
1.0
SOFT & LOOSE BROWN FIBROUS SILT SOME WOOD CHIPS
87.9
3.0
WOOD CHIPS - WATERY & LOOSE - LITTLE SILT
85.4
5.5
SOFT BROWN FIBROUS SILT WITH TRACE OF WOOD CHIPS
81.9
9.0
SOFT BROWN COHESIVE FIBROUS SILT & CLAY
73.5
17.5
DH-15
93.6
0
SOFT & LOOSE BLACK ORGANIC SILT (MUCK)
92.6
1.0
SOFT & LOOSE BROWN SILT & WOOD CHIPS
90.6
3.0
SOFT GREY ORGANIC SILT (MUCK)
88.6
5.0
WOOD CHIPS WATERY & LOOSE LITTLE SILT
86.6
7.0
BLACK ORGANIC SILT & CINDERS
84.6
9.0
SOFT & SLIGHTLY COHESIVE GREY-BROWN SILT (MUCK) WITH WOOD CHIPS
80.6
13.0
SOFT BROWN COHESIVE FIBROUS SILT
75.1
18.5
DH-17
93.0
WATER
82.9
0.0
V SOFT & SLIGHTLY COHESIVE BROWN & BLACK ORGANIC SILT
81.4
1.5
BROWN FIBROUS SILT
76.9
6.0
SOFT & COHESIVE GREY BROWN FIBROUS SILT & CLAY
71.9
11.0
DH-18
93.0
WATER
78.8
0.0
SOFT BLACK ORGANIC FIBROUS SILT
77.8
1.0
BROWN FIBROUS SILT
74.8
4.0
SOFT & COHESIVE GREY BROWN FIBROUS SILT & CLAY
69.8
11.0
DH-19
93.0
WATER
76.9
0.0
V SOFT BLACK ORGANIC FIBROUS SILT
75.9
1.0
SOFT & COHESIVE GREY-BROWN SILT & CLAY
69.4
6.5
DH-20
93.0
WATER
75.7
0.0
V SOFT BLACK ORGANIC FIBROUS SILT
74.7
1.0
SOFT & COHESIVE GREY-BROWN SILT & CLAY
68.2
6.5
DH-13
93.0
92.9
WATER
0.0
BROWN FIBROUS SILT TRACE OF WOOD CHIPS
91.9
1.0
SOFT BROWN COHESIVE FIBROUS SILT & CLAY
86.4
6.5
DH-16
93.0
92.9
WATER
0.0
V FIBROUS BROWN SILT
91.9
1.0
WET & LOOSE BROWN SILT & WOOD CHIPS
86.9
6.0
SOFT BROWN COHESIVE FIBROUS SILT
85.9
7.0
REFER TO FIG 3 FOR BORING LOCATIONS

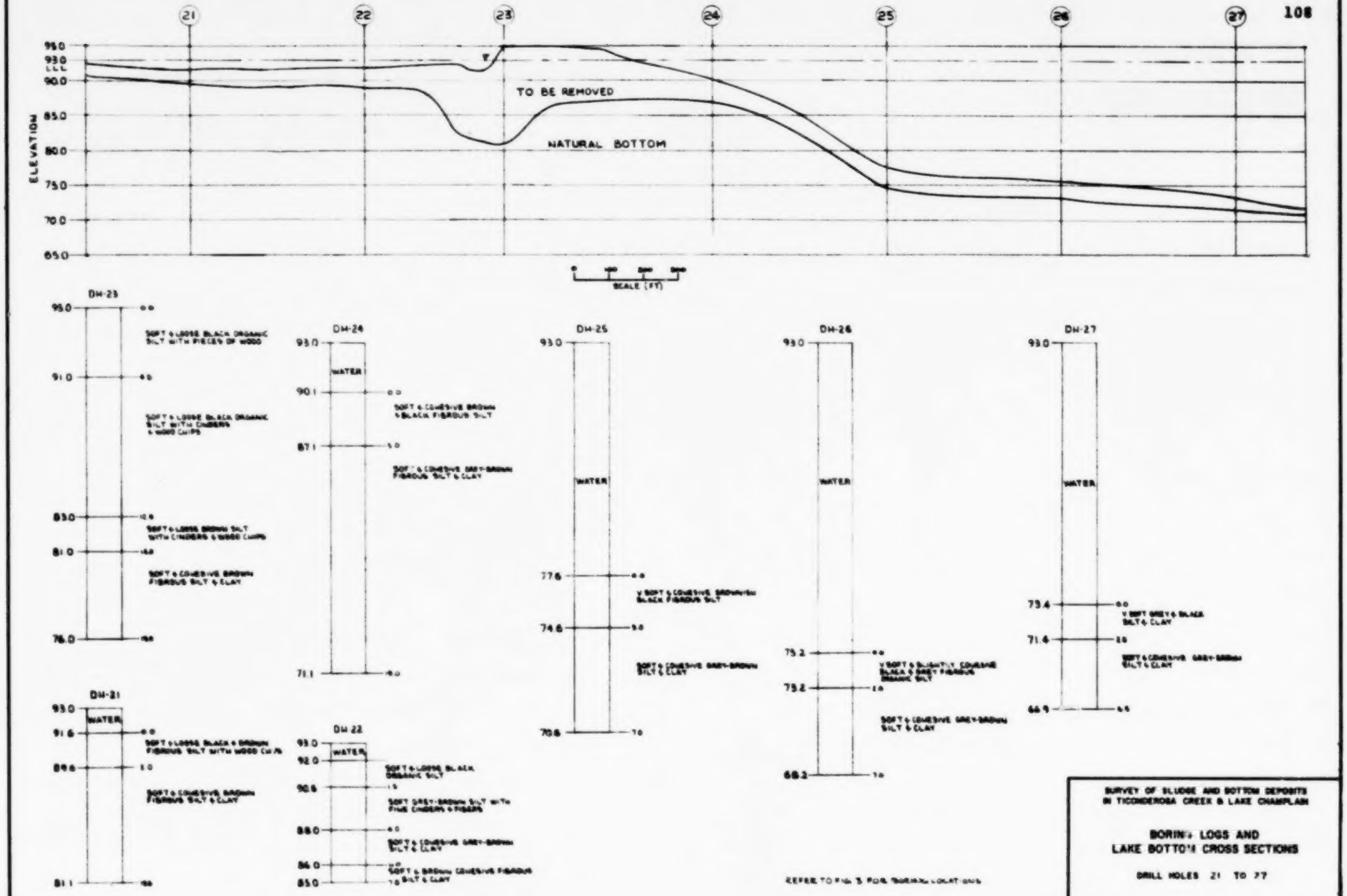
SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

BORING LOGS AND
LAKE BOTTOM CROSS SECTIONS

DRILL HOLES 13 TO 20

TICONDEROGA NEW YORK

FIGURE NO. 12


21
22
23
24
25
26
27
95.0
93.0
L.L.L.
90.0
85.0
80.0
75.0
70.0
65.0
ELEVATION
TO BE REMOVED
NATURAL BOTTOM
SCALE (FT)
DH-23
95.0
91.0
83.0
81.0
76.0
0.0
4.0
12.0
14.0
19.0
SOFT & LOOSE BLACK ORGANIC SILT WITH PIECES OF WOOD
SOFT & LOOSE BLACK ORGANIC SILT WITH CINDERS & WOOD CHIPS
SOFT & LOOSE BROWN SILT WITH CINDERS & WOOD CHIPS
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
DH-24
93.0
90.1
87.1
71.1
WATER
0.0
3.0
19.0
SOFT & COHESIVE BROWN & BLACK FIBROUS SILT
SOFT & COHESIVE GREY-BROWN FIBROUS SILT & CLAY
DH-21
93.0
91.6
89.6
81.1
WATER
0.0
2.0
SOFT & LOOSE BLACK & BROWN FIBROUS SILT WITH WOOD CHIPS
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
DH-22
93.0
92.0
90.6
88.0
86.0
85.0
WATER
1.5
4.0
6.0
7.0
SOFT & LOOSE BLACK ORGANIC SILT
SOFT GREY-BROWN SILT WITH FINE CINDERS & FIBERS
SOFT & COHESIVE GREY-BROWN SILT & CLAY
SOFT & BROWN COHESIVE FIBROUS SILT & CLAY
DH-25
93.0
77.6
74.6
70.6
WATER
0.0
3.0
7.0
V SOFT & COHESIVE BROWNISH BLACK FIBROUS SILT
SOFT & COHESIVE GREY-BROWN SILT & CLAY
DH-26
93.0
75.2
73.2
68.2
WATER
0.0
2.0
7.0
V SOFT & SLIGHTLY COHESIVE BLACK & GREY FIBROUS ORGANIC SILT
SOFT & COHESIVE GREY-BROWN SILT & CLAY
DH-27
93.0
73.4
71.4
66.9
WATER
0.0
2.0
6.5
V SOFT GREY & BLACK SILT & CLAY
SOFT & COHESIVE GREY-BROWN SILT & CLAY

REFER TO FIG. 3 FOR BORING LOCATIONS

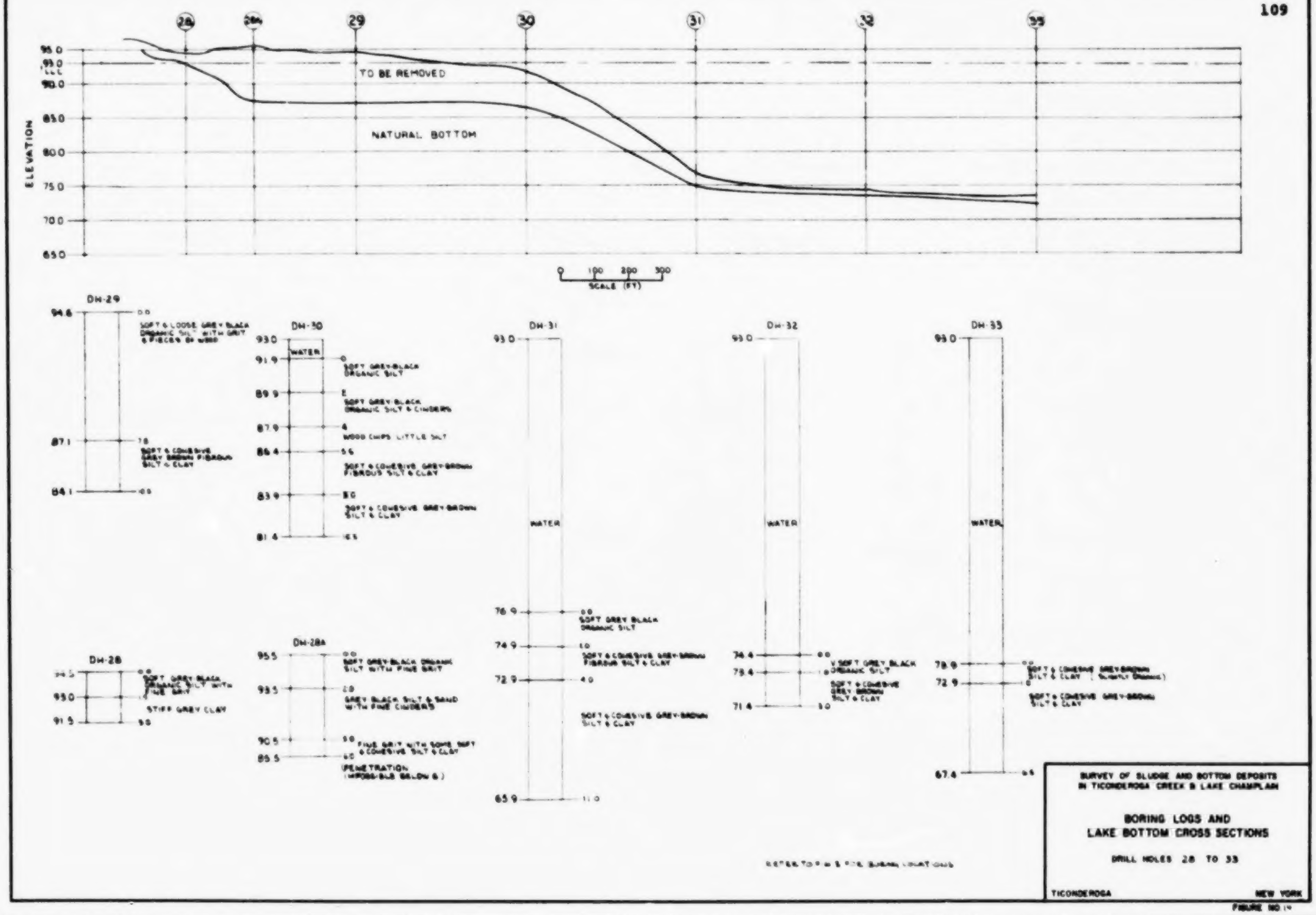
SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

BORING LOGS AND
LAKE BOTTOM CROSS SECTIONS

DRILL HOLES 21 TO 27

TICONDEROGA NEW YORK

FIGURE NO.13


28
28A
29
30
31
32
33
95.0
93.0
L.L.L.
90.0
85.0
80.0
75.0
70.0
65.0
ELEVATION
TO BE REMOVED
NATURAL BOTTOM
0
100
200
300
SCALE (FT)
DH-29
94.6
0.0
SOFT & LOOSE GREY-BLACK ORGANIC SILT WITH GRIT & PIECES OF WOOD
87.1
7.5
SOFT & COHESIVE GREY BROWN FIBROUS SILT & CLAY
84.1
10.5
DH-30
93.0
WATER
91.9
0
SOFT GREY-BLACK ORGANIC SILT
89.9
2
SOFT GREY-BLACK ORGANIC SILT & CINDERS
87.9
4
WOOD CHIPS LITTLE SILT
86.4
5.5
SOFT & COHESIVE GREY-BROWN FIBROUS SILT & CLAY
83.9
8.0
SOFT & COHESIVE GREY-BROWN SILT & CLAY
81.4
10.5
DH-31
93.0
WATER
76.9
0.0
SOFT GREY BLACK ORGANIC SILT
74.9
1.0
SOFT & COHESIVE GREY-BROWN FIBROUS SILT & CLAY
72.9
4.0
SOFT & COHESIVE GREY-BROWN SILT & CLAY
65.9
11.0
DH-32
93.0
WATER
74.4
0.0
V SOFT GREY BLACK ORGANIC SILT
73.4
1.0
SOFT & COHESIVE GREY BROWN SILT & CLAY
71.4
3.0
DH-33
93.0
WATER
73.9
0.0
SOFT & COHESIVE GREY-BROWN SILT & CLAY (SLIGHTLY ORGANIC)
72.9
1
SOFT & COHESIVE GREY-BROWN SILT & CLAY
67.4
6.5
DH-28
94.5
0.0
SOFT GREY-BLACK ORGANIC SILT WITH FINE GRIT
93.0
1.5
STIFF GREY CLAY
91.5
3.0
DH-28A
95.5
0.0
SOFT GREY-BLACK ORGANIC SILT WITH FINE GRIT
93.5
2.0
GREY BLACK SILT & SAND WITH FINE CINDERS
90.5
5.0
FINE GRIT WITH SOME SOFT & COHESIVE SILT & CLAY
89.5
6.0
(PENETRATION IMPOSSIBLE BELOW 6)

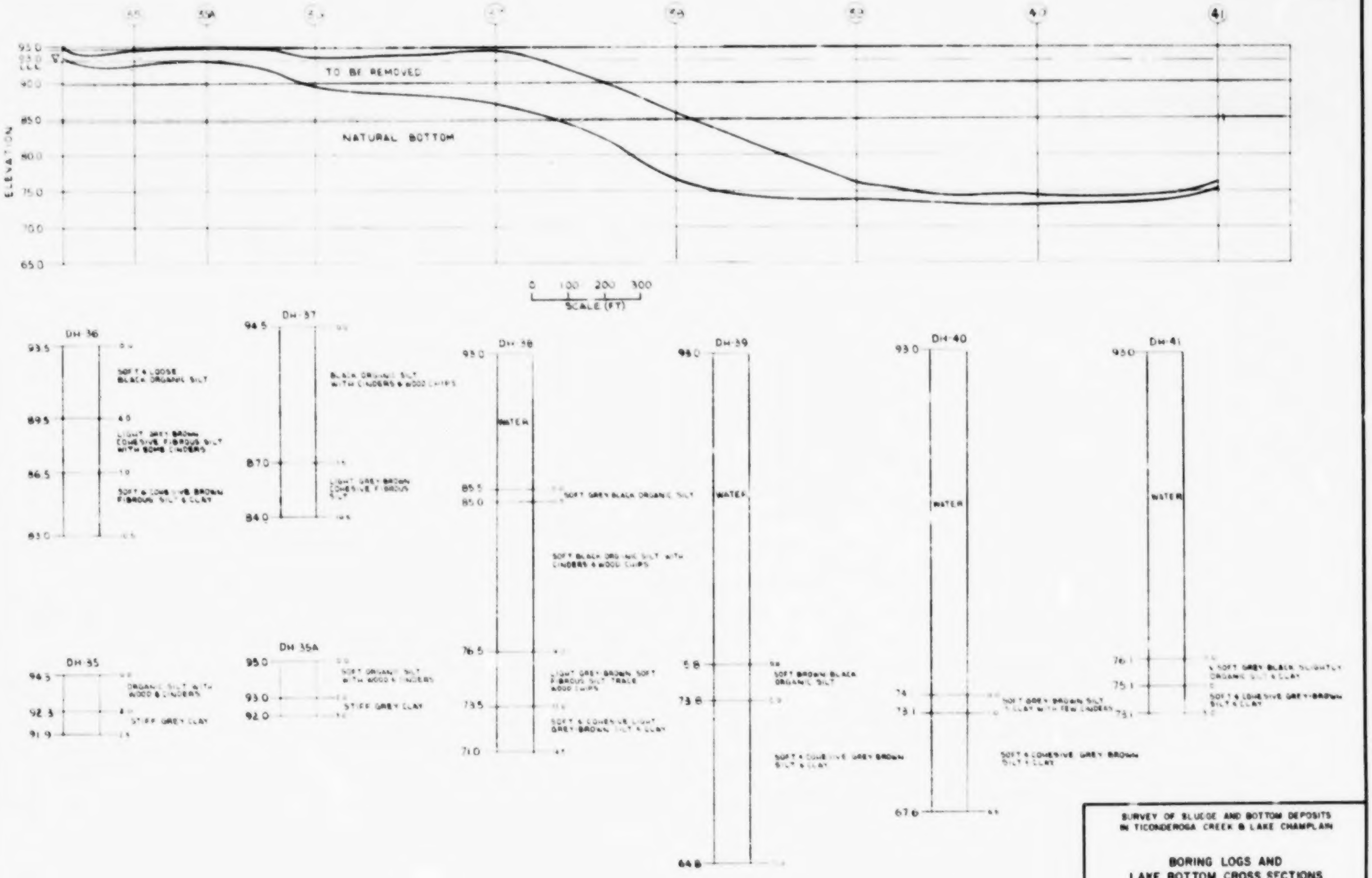
SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

BORING LOGS AND
LAKE BOTTOM CROSS SECTIONS

DRILL HOLES 28 TO 33

TICONDEROGA NEW YORK

FIGURE NO 14

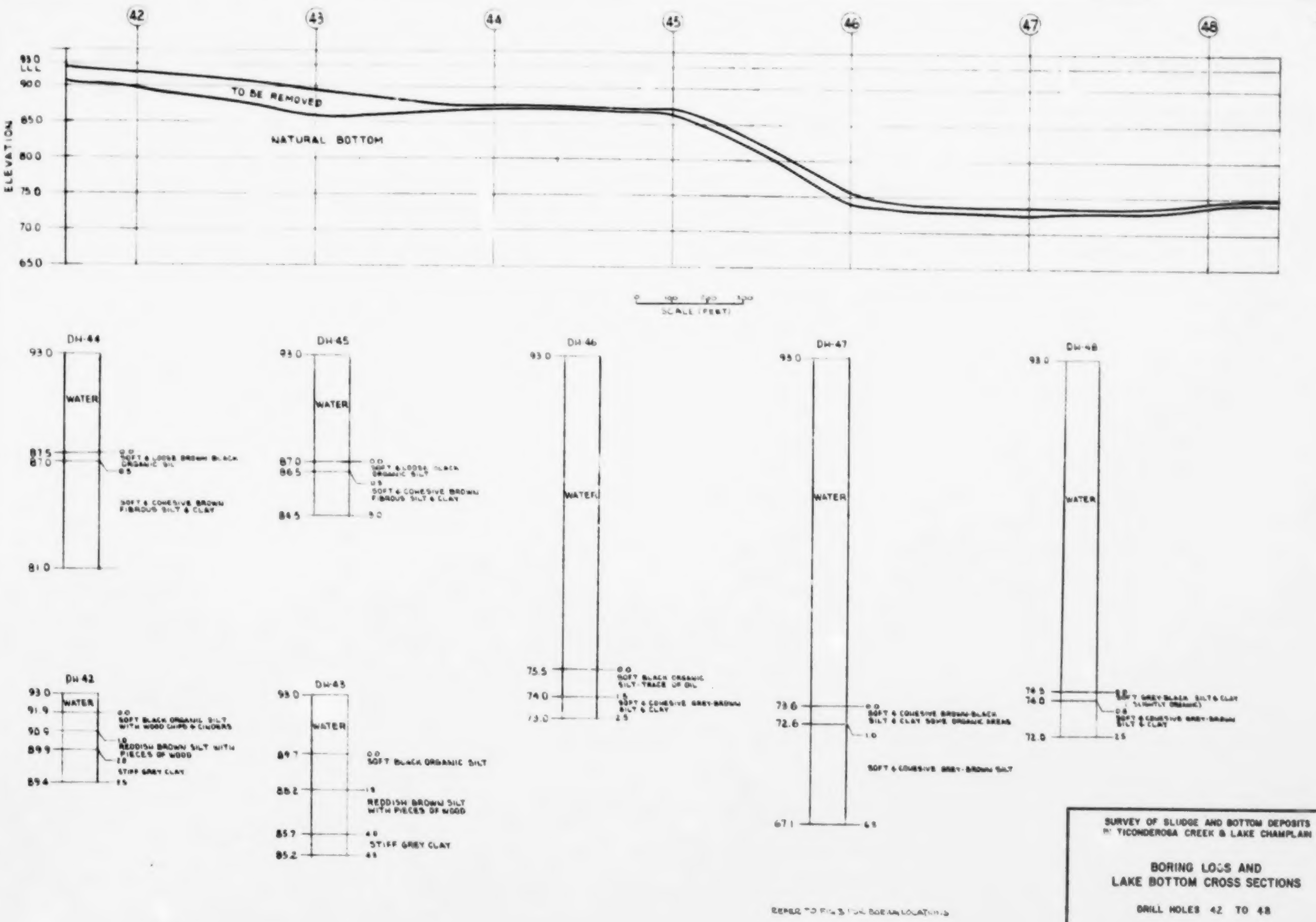

35
35A
93.0
90.0
85.0
80.0
75.0
70.0
65.0
ELEVATION
41
TO BE REMOVED
NATURAL BOTTOM
0 100 200 300
SCALE (FT)
DH-36
93.5
89.5
86.5
83.0
4.0
SOFT & LOOSE BLACK ORGANIC SILT
LIGHT GREY BROWN COHESIVE FIBROUS SILT WITH SOME CINDERS
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
DH-37
94.5
87.0
84.0
BLACK ORGANIC SILT WITH CINDERS & WOOD CHIPS
LIGHT GREY BROWN COHESIVE FIBROUS SILT
DH-35
94.5
92.3
91.9
ORGANIC SILT WITH WOOD & CINDERS
STIFF GREY CLAY
DH-35A
95.0
93.0
92.0
SOFT ORGANIC SILT WITH WOOD & CINDERS
STIFF GREY CLAY
DH-38
95.0
85.5
85.0
76.5
73.5
71.0
WATER
SOFT GREY BLACK ORGANIC SILT
SOFT BLACK ORGANIC SILT WITH CINDERS & WOOD CHIPS
LIGHT GREY BROWN SOFT FIBROUS SILT TRACE WOOD CHIPS
SOFT & COHESIVE LIGHT GREY BROWN SILT & CLAY
DH-39
95.0
5.8
73.8
64.8
WATER
SOFT BROWN BLACK ORGANIC SILT
SOFT & COHESIVE GREY BROWN SILT & CLAY
DH-40
93.0
74
73.1
67.6
WATER
SOFT GREY BROWN SILT & CLAY WITH FEW CINDERS
SOFT & COHESIVE GREY BROWN SILT & CLAY
DH-41
95.0
76.1
75.1
73.1
WATER
SOFT GREY BLACK SLIGHTLY ORGANIC SILT & CLAY
SOFT & COHESIVE GREY-BROWN SILT & CLAY

SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

BORING LOGS AND
LAKE BOTTOM CROSS SECTIONS

DRILL HOLES 35 TO 41

TICONDERO A
NEW YORK
FIGURE NO 5


42
43
44
45
46
47
48
ELEVATION
93.0
LLL
90.0
85.0
80.0
75.0
70.0
65.0
TO BE REMOVED
NATURAL BOTTOM
0
100
200
300
SCALE (FEET)
DH-44
93.0
WATER
81.5
87.0
81.0
0.0
SOFT & LOOSE BROWN BLACK ORGANIC SIL
0.5
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
DH-45
93.0
WATER
87.0
86.5
84.5
0.0
SOFT & LOOSE BLACK ORGANIC SILT
0.5
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
9.0
DH-46
93.0
WATER
75.5
74.0
73.0
0.0
SOFT BLACK ORGANIC SILT-TRACE OF OIL
1.5
SOFT & COHESIVE GREY-BROWN SILT & CLAY
2.5
DH-47
93.0
WATER
73.6
72.6
67.1
0.0
SOFT & COHESIVE BROWN-BLACK SILT & CLAY SOME ORGANIC AREAS
1.0
SOFT & COHESIVE GREY-BROWN SILT
6.5
DH-48
93.0
WATER
74.5
74.0
72.0
0.0
SOFT GREY-BLACK SILT & CLAY (SLIGHTLY ORGANIC)
0.8
SOFT & COHESIVE GREY-BROWN SILT & CLAY
2.5
DH 42
93.0
WATER
91.9
90.9
89.9
89.4
0.0
SOFT BLACK ORGANIC SILT WITH WOOD CHIPS & CINDERS
1.0
REDDISH BROWN SILT WITH PIECES OF WOOD
2.0
STIFF GREY CLAY
2.5
DH-43
93.0
WATER
89.7
88.2
85.7
85.2
0.0
SOFT BLACK ORGANIC SILT
1.5
REDDISH BROWN SILT WITH PIECES OF WOOD
4.0
STIFF GREY CLAY
4.5

REFER TO FIG. 3 FOR BORING LOCATIONS

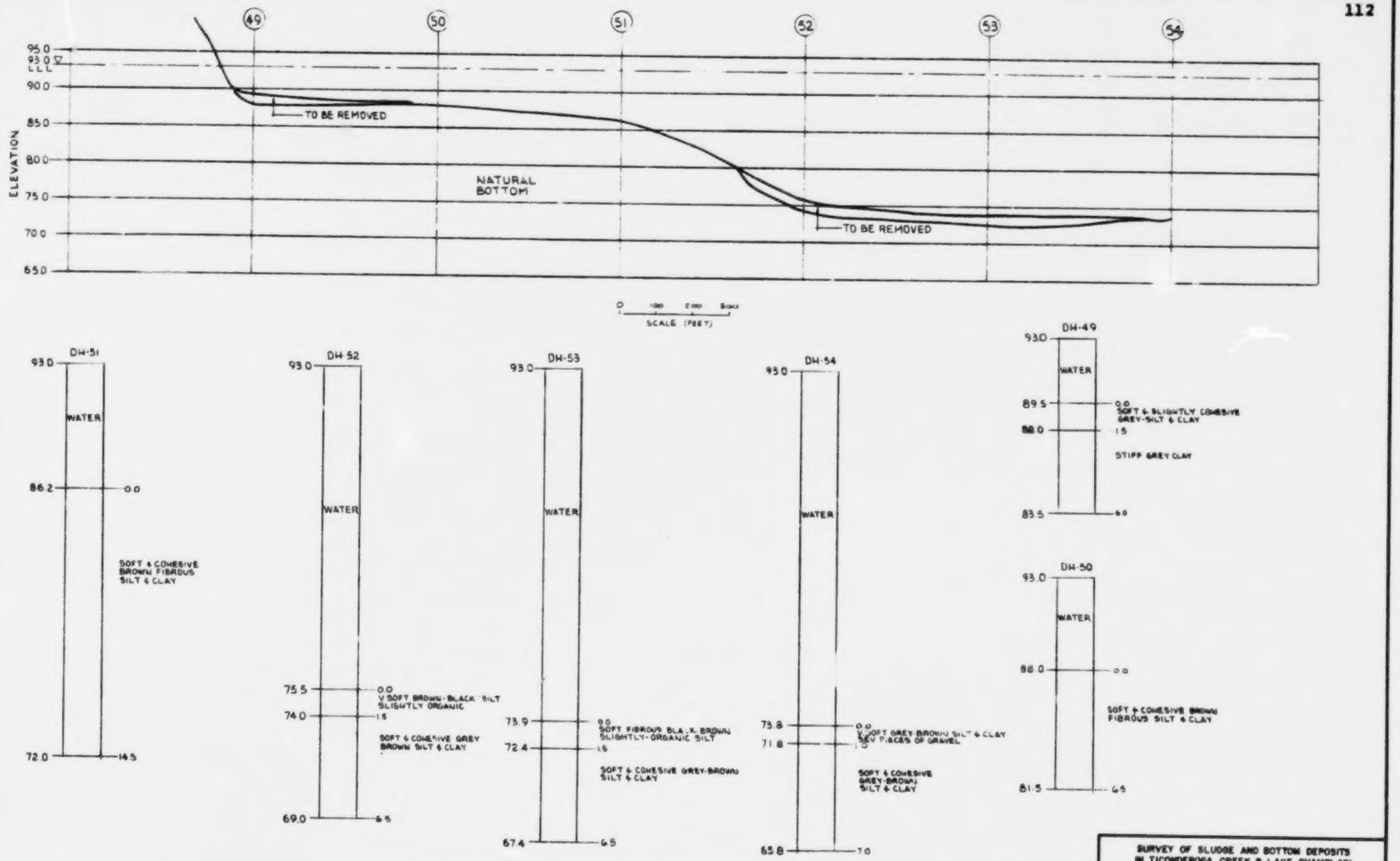
SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

BORING LOGS AND
LAKE BOTTOM CROSS SECTIONS

DRILL HOLES 42 TO 48

TICONDEROGA NEW YORK

FIGURE NO. 16


49
50
51
52
53
54
95.0
93.0 ▽
L.L.L.
90.0
85.0
80.0
75.0
70.0
65.0
ELEVATION
TO BE REMOVED
NATURAL BOTTOM
TO BE REMOVED
0
100
200
300
SCALE (FEET)
DH-51
93.0
WATER
86.2
0.0
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
72.0
14.5
DH-52
93.0
WATER
75.5
0.0
V SOFT BROWN-BLACK SILT SLIGHTLY ORGANIC
74.0
1.5
SOFT & COHESIVE GREY BROWN SILT & CLAY
69.0
6.5
DH-53
93.0
WATER
73.9
0.0
SOFT FIBROUS BLACK BROWN SLIGHTLY-ORGANIC SILT
72.4
1.5
SOFT & COHESIVE GREY-BROWN SILT & CLAY
67.4
6.5
DH-54
93.0
WATER
73.8
0.0
V SOFT GREY-BROWN SILT & CLAY SEV PIECES OF GRAVEL
71.8
1.5
SOFT & COHESIVE GREY-BROWN SILT & CLAY
65.8
7.0
DH-49
93.0
WATER
89.5
0.0
SOFT & SLIGHTLY COHESIVE GREY-SILT & CLAY
88.0
1.5
STIFF GREY CLAY
83.5
6.0
DH-50
93.0
WATER
88.0
0.0
SOFT & COHESIVE BROWN FIBROUS SILT & CLAY
81.5
6.5

REFER TO FIG 5 FOR BORING LOCATIONS

SURVEY OF SLUDGE AND BOTTOM DEPOSITS
IN TICONDEROGA CREEK & LAKE CHAMPLAIN

BORING LOGS AND
LAKE BOTTOM CROSS SECTIONS

DRILL HOLES 49 TO 54

TICONDEROGA NEW YORK

FIGURE NO. 17

APPENDIX A

COST ESTIMATE - UPLAND DISPOSAL

Yardage Removed - c.y.	1,530,000
Dredge Output - c.y./day	4,000
Effective Working Days Per Month	25
Dredge Output - c.y./month	100,000
Months required for Completion	15 9/30
Monthly Cost of Dredge and Boosters	$169,500
Total Cost of Dredging	$2,593,350
Material and Construction Costs	$10,000
Field Engineering and Supervision	$31,450
Mobilization and Demobilization	$135,000
Distributed Costs (insurance, taxes, etc.)	$221,600
Additional Pay (vacation, holiday, overtime)	$67,500
Sub-total	$3,058,900
Contractor's Overhead 12%	$367,070
Bond Costs	$15,000
Sub-total	$3,440,970
Profit 15%	$516,145
Total Construction Cost	$3,957,115
Estimated Cost Per Cubic Yard	$2.60
Contingencies 15% (Includes Engineering and Design, and Supervision and Administration)	$569,150
TOTAL PROJECT COST	$ 4,363,477
Say	$ 4,400,000

APPENDIX B

COST ESTIMATE - DEEP WATER DISPOSAL

Yardage Removed - c.y.		2,319,400
Dredge Output c.y./day		4,100
Effective Working Days Per Month		25
Dredge Output c.y./month		102,500
Months Required for Completion		22 19/30
Monthly Cost of Dredge and Barges		$92,300
Total Cost of Dredging		$2,095,200
Material and Construction Costs		$8,000
Field Engineering and Supervision		$43,950
Mobilization and Demobilization		$50,000
Sub-total		$2,197,150
Distributed Costs (insurance, taxes, etc.)		$175,600
Additional Pat (vacation, holiday, overtime)		$96,500
Sub-total	$	$2,469,250
Contractor's Overhead 12%		$296,300
Bond Costs		$20,750
Sub-total		$2,786,310
Profit 15%		$417,950
Total Contract Cost		$3,204,260
Estimated Cost Per Cubic Yard		$1.40
Contingencies 15% (Includes Engineering and Design, and Supervision and Administration)		$480,650
TOTAL PROJECT COST		$3,684,910
	Say	$3,700,000

UNITED STATES
DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
NORTHEAST REGION
JOHN F. KENNEDY FEDERAL BUILDING
BOSTON, MASSACHUSETTS 02203

December 23, 1968

Division Engineer
North Atlantic Division
Corps of Engineers
U. S. Department of the Army
26 Federal Plaza
New York, New York 10007

ATTENTION: Mr. Frank Panuzio

Dear Sir:

We would like to explore the possibility of the Corps of Engineers conducting a survey and sampling of bottom deposits in Lake Champlain in the vicinity of Ticonderoga Creek.

The survey would determine the volume and location of the sludge deposits using core sampling along with an evaluation of the physical stability, best method of disposal, and associated costs. The Corps could contract the boring portion of the work if necessary. The Federal Water Pollution Control Administration laboratory would perform chemical analyses of the sludge samples.

We expect that the number of borings would be approximately 50 to 60. In order to facilitate locating test holes, increase the number of borings per day and eliminate manipulation of a boat to a certain spot, it is recommended that the work be carried out while a thick ice cover is still on the lake. The conferees at the recent Federal enforcement conference on Lake Champlain requested that the results of the sludge studies be reported by September 1, 1969.

The New England Division has carried out two surveys of this type for us in the past - on the St. Croix River and the Presumpscot River. Because of the past experience of the New England Division, it may be desirable to explore the possibility of having them handle the Lake Champlain survey.

If you are able to carry out the study for us on a reimbursable basis, we can meet to discuss the details. An early reply would be appreciated.

Sincerely yours,

Lester M. Klashman

Lester M. Klashman
Regional Director

ATTACHMENT 1

STATE OF NEW YORK
CONSERVATION DEPARTMENT *Division of Fish and Game*

R. STEWART KILBORNE
Commissioner
W. MASON LAWRENCE
Deputy Commissioner
LEIGHTON A. HOPE
Deputy Commissioner
ROBERT E. YOUNG
Deputy Commissioner
IRWIN H. KING
Secretary

A.G. Hall
Director
(518) 457-5680
D.H. Wallace
Deputy Director
of Fish and Game
for Marine Region
(516) 585-5400
W.G. Bentley
Assistant Director
for Fish and Game
(518) 457-5680
W.J. Goodman
Assistant Director
for Law Enforcement
and Field Services
(518) 457-5680

September 5, 1969.

Mr. Frank Haber
Corps of Engineers
Foot of Bond Street
Troy, New York 12180

Dear Mr. Haber:

This is a follow-up of your telephone call of September 4, 1969 concerning dredging paper pulp residue from Lake Champlain near Ticonderoga and using an existant marsh along Ticonderoga Creek as a dumping basin. I have checked with my fisheries and game staffs.

While we recognize the desirability of removing the accumulated paper pulp from the lake bottom, we doubt that the gains would be worth the losses. From both the game and fisheries standpoint we are against filling the marsh along Ticonderoga Creek.

This marsh is productive of waterfowl, providing several broods a year. It also attracts ducks in the fall for hunting opportunity. The increased attractivity of the lake waters for ducks sometime in the future after dredging would never compensate for the loss of that Ticonderoga Creek Marsh.

Our viewpoint from a fisheries standpoint is not much different. The Ticonderoga Creek Marsh is a popular spring bullhead fishing area. Throughout the rest of the year the area serves as spawning and rearing grounds for some fish and as an important point for the production of animal life for the food chain for many species. While sometime in the future the removal of the paper pulp residue would improve the area for fish, the area now has some value to fish which will also increase as silt drifts down on the residue. We believe the increase in value would compensate for the loss of the Ticonderoga Creek Marsh.

ATTACHMENT 2-1

STATE OF NEW YORK
CONSERVATION DEPARTMENT *Division of Fish and Game*

R. STEWART KILBORNE
Commissioner
W. MASON LAWRENCE
Deputy Commissioner
LEIGHTON A. HOPE
Deputy Commissioner
ROBERT E. YOUNG
Deputy Commissioner
IRWIN H. KING
Secretary

A.C. Hall
Director
(518) 457-5690
D.H. Wallace
Deputy Director
of Fish and Game
for Marine Region
(516) 585-5400
W.G. Bentley
Assistant Director
for Fish and Game
(518) 457-5690
W.J. Goodman
Assistant Director
for Law Enforcement
and Field Services
(518) 457-5690

September 5, 1969.

Mr. Haber Page -2-

Therefore, we stand opposed to filling the Ticonderoga Creek Marsh which has a known value for other values that may or may not materialize. Our Albany Office concurs on this decision.

Sincerely yours,

Dirck Benson
DIRCK BENSON
Regional Supervisor of
Fish & Game, Region 5
Ray Brook, New York 12977
d.s.

DB:vs

cc. D. Foley
S.D.Browne

ATTACHMENT 2-2

REPORT ON SURVEY OF SLUDGE AND BOTTOM DEPOSITS
TICONDEROGA CREEK AND LAKE CHAMPLAIN - TICONDEROGA, N.Y.

ADDENDUM TO REPORT

This addendum proposes two additional solutions to the problem of the sludge and bottom deposits at Ticonderoga Creek and Lake Champlain at Ticonderoga, N.Y. The purpose of the report was to suggest means and provide costs for removal and disposal of the accumulated deposits from the area. Since removal and disposal may prove to be financially unfeasable two additional proposals are hereby submitted that do not include complete disposal of the deposits. These two plans involve; A) Covering the sludge deposits with a two foot layer of sand and B) Dredging the most volatile material in Lake Champlain and Ticonderoga Creek and placing it in a dike built below Fort Ticonderoga in Lake Champlain.

SAND COVER. Covering the accumulated sludge with a pervious material such as a sand blanket will allow gases to escape but will keep the volatile material from breaking free and floating to the surface. The first step in this plan will be the dredging of Ticonderoga Creek and a channel out into the lake to the 10 foot countour. This material will have to be spoiled on top of existing deposits somewhere in the lake. The second phase involves cutting furrows as indicated on the accompanying plan for barge access. This will take approximately 3 months using a clamshell rig. The sand cover will then be spread over the lake bottom by use of a barge mounted crane and bucket. The sand is spread by "broadcasting". The previously cut furrows allow access for the crane and sand barges. Allowing for a total of 600,000 cubic yards of sand to be spread over the lake bottom, at a rate of two barges or 1500 cubic yards a day, one crane will accomplish this in 400 days. Thus, depending on the amount of equipment used at one time, the project can be accomplished in 1 to 3 years.

LAND RECLAMATION. The feature of this plan is the building of a dike in Lake Champlain to hold the spoiled material. The dike is planned to be located below Fort Ticonderoga and will accomodate spoil material from Ticonderoga Creek and the more volatile material from Lake Champlain. The location of the dike and the areas to be dredged are shown on the accompanying plan. The dike will be built to elevation + 103.0 or 1.2 feet above high lake level. After the spoiled material is in place a 3' layer of sand will be placed for consolidation of the sludge and then the area will be topsoiled. This reclamation will create approximately 45 acres of land that may be used for recreational purposes.

COST ESTIMATES. Included in the costs for both estimates were dredging Ticonderoga Creek of 100,000 yards of accumulated material. The unit prices given for quantities include equipment and placement of materials. An additional 15% was added for engineering and design.

SUMMARY OF ESTIMATED COSTS

SAND COVER	$2,200,000
LAND RECLAMATION	$2,130,000

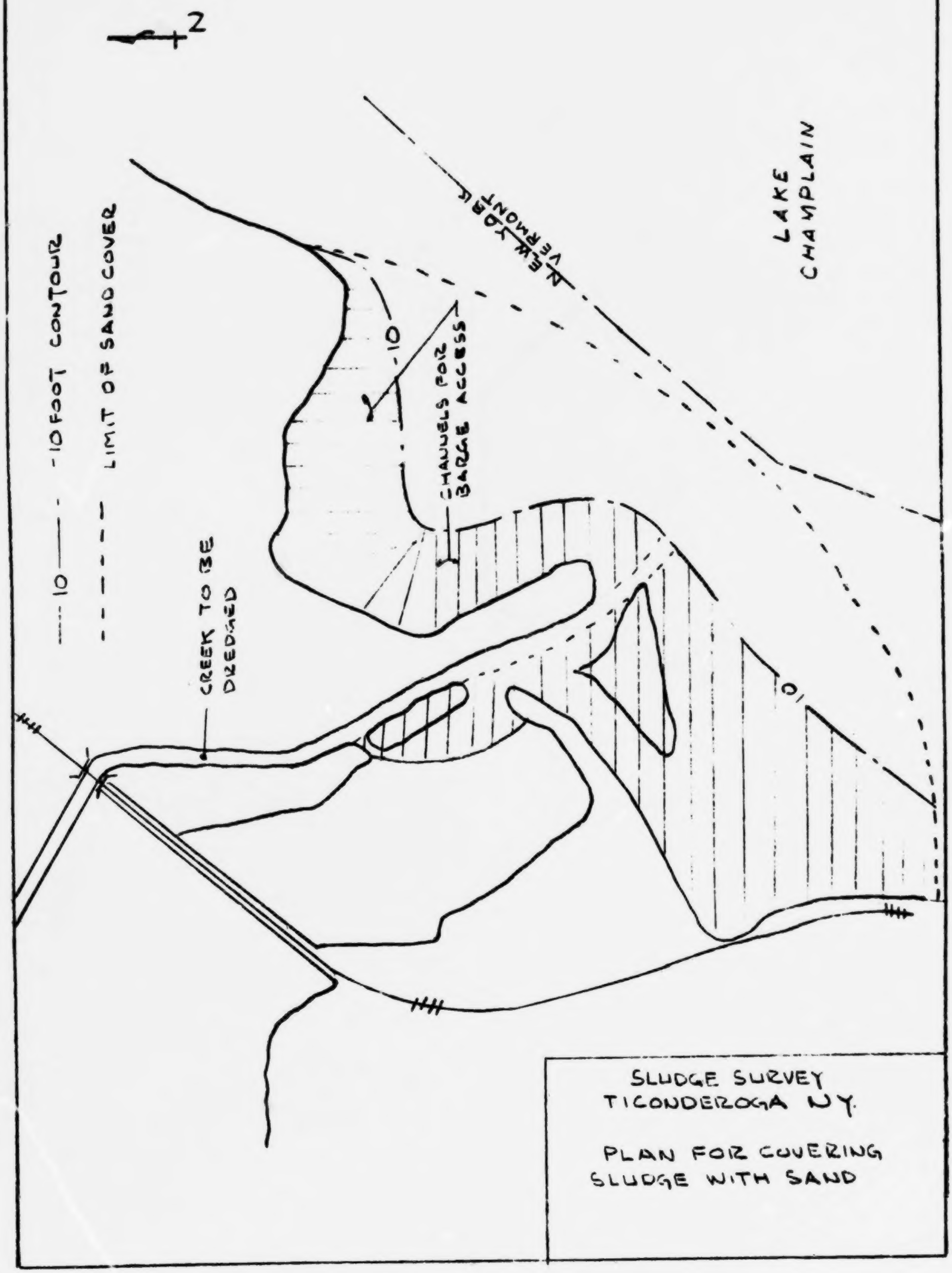
COST ESTIMATES

SAND COVER

DREDGING FURROWS		$ 25,000
DREDGING CREEK		$ 100,000
SAND COVER 600,000 cubic yards @ $3.00 cu.yd.		$1,800,000
	TOTAL	$1,925,000
15% ENGINEERING AND DESIGN		275,000
	TOTAL	$2,200,000

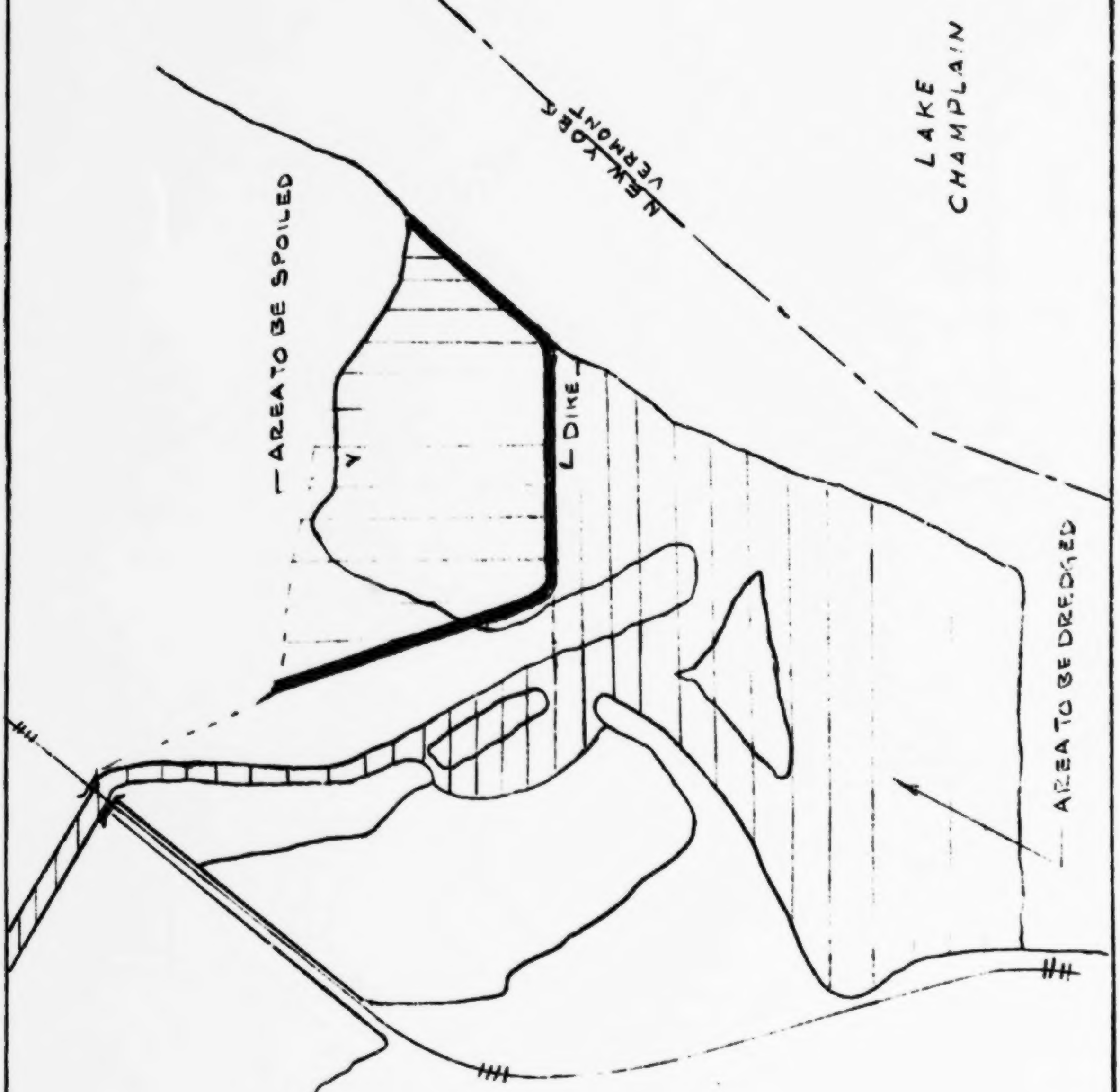
LAND RECLAMATION

DIKE CONSTRUCTION 250,000 cubic yards @ $3,00 cu.yd.		$ 750,000
DREDGING 850,000 cubic yards @ $1.00 cu.yd.		$ 850,000
SAND COVER 60,000 cubic yards @ $3.00 cu.yd.		$ 180,000
TOPSOIL 54 acres @ $1500/acre		70,000
	TOTAL	$1,850,000
15% ENGINEERING AND DESIGN		278,000
		$2,128,000


N
10 — 10 FOOT CONTOUR
- - - LIMIT OF SAND COVER
CREEK TO BE DREDGED
CHANNELS FOR BARGE ACCESS
10
10
NEW YORK
VERMONT
LAKE CHAMPLAIN

SLUDGE SURVEY
TICONDEROGA N.Y.

PLAN FOR COVERING
SLUDGE WITH SAND


AREA TO BE SPOILED
NEW YORK
VERMONT
LAKE CHAMPLAIN
DIKE
AREA TO BE DREDGED

SLUDGE SURVEY
TICONDEROGA N.Y.

PLAN FOR LAND RECLAMATION USING SPOILED SLUDGE

Albert Bromberg

MR. BROMBERG: I will now present a summary of the U. S. Army Corps of Engineers report.

A total of 76 test borings were made by the Corps, 56 of which were at the mouth of Ticonderoga Creek and in the sludge delta in Lake Champlain. Sludge Depths varied from less than 1 foot up to 12 feet. The deposits covered an area of approximately 300 acres and extended up to 600 feet from the New York shore into Lake Champlain.

And, Mr. Chairman and conferees, I refer you to this slide of the Ticonderoga Bay area behind me. And the area outlined in red is the area that is affected by the sludge deposits. And I might add, most seriously affected. There is a fringe outside of the lined area which is also covered by a lighter deposition of deposits.

MR. PAHREN: That fringe does extend into Vermont, Mr. Bromberg?

MR. BROMBERG: Yes, it does extend across the State line.

The bulk of the deposits are on the New York side of the lake although there appears to be a carryover of shallow deposits (less than one foot in depth) across the State line. Approximately 1,430,000 cubic yards of sludge, wood chips, cinders and organic material were found in Ticonderoga Creek, a marsh adjacent to the creek, and in Lake Champlain. More than half the volume of these deposits, or 802,000 cubic yards, were found in Lake Champlain.

The Corps investigated four alternative methods of disposal of the sludge deposits. All alternatives were hampered by the lack of adequate spoil disposal areas. Several disposal sites were considered but were subsequently rejected for various reasons. The alternatives considered were as follows:

1. Hydraulic dredging with spoils disposal to an upland area (approximately 2 miles northwest of Ticonderoga Bay).

I will point out this area.

Estimated cost, $4,400,000.

2. Clamshell dredging with transport of spoils in scows to a point 20 miles north of Ticonderoga Bay (north of Port Henry) and disposal of spoils in Lake Champlain in depths not less than 150 feet.

Estimated cost of this alternative, $3,700,000.

3. Covering the in-place sludge deposits with a sand blanket.

And, again, I point out that the in-place deposits are the areas in red.

Estimated cost, $2,200,000.

4. Construction of a dike in the shallow areas of

Ticonderoga Bay. Hydraulically dredging deposits for disposal behind this dike. After draining and consolidation of spoils, cover spoils with sand and topsoil for land reclamation.

Estimated cost of this alternative, $2,130,000.

I will point out to you the area that might be considered for the construction of this dike and disposal area. It could possibly be the shallow area extending between Fort Ticonderoga which is on the hill here, the shallow area of the bay here. It could possibly include a diking in this area here which is a marsh area to the southeast of the creek proper which comes down here.

The Technical Committee met to review the results of the sludge survey and make recommendations on the water quality requirements at the State line between New York and Vermont. The committee report to the conferees of the Lake Champlain Enforcement Conference is as follows:

"A Technical Committee of water pollution control representatives from New York, Vermont, and New England Interstate Water Pollution Control Commission, and the Federal Water Quality Administration was established by the conferees at the first session of the Conference on Pollution of the Interstate Waters of Lake Champlain and its Tributary Basin.

"The Technical Committee reviewed the results of the studies that had been carried out since the first conference session by the U. S. Army Corps of Engineers and the Federal Water Quality Administration and discussed alternative proposals concerning the sludge deposits near the mouth of Ticonderoga Creek. The committee also discussed the consistency of water quality criteria at the State line between Vermont and New York.

"Results of the technical studies confirm that the major source of the sludge deposits was the discharge of suspended solids from the International Paper Company plant at Ticonderoga, New York.

"It is the majority opinion of the committee that the best solution to the existing sludge problem is the removal of the sludge from Ticonderoga Creek and Lake Champlain. Placement of the spoils behind a dike constructed near the mouth of Ticonderoga Creek (Corps of Engineers alternative entitled 'Land Reclamation') appears to be the most economical solution. If more detailed studies reveal that serious problems may be encountered in removing the sludge, then the second choice of the Technical Committee is to cover the sludge in place with a sand cover, if determined technically feasible.

"Vermont will maintain a minimum dissolved oxygen concentration of 5.0 mg/l at all times in Lake Champlain at the State line. Although New York's criteria require a minimum of 4.0 mg/l dissolved oxygen in the lake, New York will

Albert Bromberg

maintain sufficient dissolved oxygen so as to meet the Vermont criteria at the State line. No mixing zone for a New York discharge will extend into Vermont.

"Because of the differences in temperature and bacterial criteria for water classification between New York and Vermont, New York will manage the water quality on its side of Lake Champlain so as to achieve the Vermont criteria at the State line in those sections where the Vermont criteria are more restrictive. Likewise, Vermont will manage the water quality on its side of the lake so as to achieve the New York criteria at the State line in those sections where the New York criteria are more restrictive.

"Lake Champlain is used as a water supply in both Vermont and New York. It is also used extensively for recreational purposes. Therefore, the Technical Committee recommends that adequate year-around disinfection be required of all domestic discharges directly to the lake and to domestic discharges to tributaries when such discharges are likely to affect the bacterial quality of water supplies of the lake."

That concludes the recommendations of the Technical Committee.

The Technical Committee raised certain questions regarding the proposed dredging operations and the characteristics of the resulting spoils. These questions were submitted to the U.S. Army Corps of Engineers, who replied as follows:

QUESTION: What area of Lake Champlain would be affected by a dredging operation in Ticonderoga Bay?

ANSWER: The area affected by the dredging is determined primarily by the type of dredge used and, secondly, by the location of the dredge. A clamshell dredge will create a greater disturbance with suspended solids than would a hydraulic dredge. The area would also be affected by the proximity of the dredge to the lake and creek currents. For this study it is considered that in water up to 10 feet in depth that the effect of clamshell dredging would extend approximately 50 feet beyond the limit of dredging and the effect of hydraulic dredging would extend approximately 10 feet beyond the limit of dredging. This effect would be in the immediate area of dredging and the possible effect on other areas of the lake would be dependent upon prevailing currents, wind direction and wave action which are not known at this time.

QUESTION: The dewatering characteristics of the spoils after dredging? In other words, what are the dewatering characteristics after dredging?

ANSWER: Dewatering characteristics will depend upon the drainage provided, the depth of the spoiled material and the ratio of the surface area to the total volume. Dewatering by evaporation can only be considered for 8 months of the year because of a snow cover or frost condition for the remainder of the year. Considerable difficulty in dewatering will be encountered if the material is spoiled in the gully area. And this refers to the Corps' alternative No. 1 which was the upland disposal. And that was the gully area I pointed out in the upper village.

Even if adequate drainage is provided, the depth of the material, (upwards of 50 feet) precludes rapid dewatering. The nature of the material itself (i.e., silts and clays) does not permit rapid dewatering.

QUESTION: Ability of the spoils to support a cover? This is for the spoils after they have been dredged.

ANSWER: The spoiled material will be able to support a sand cover. However, consideration must be given to the depth of the spoiled material and the material upon which the spoil is placed. If the sand cover is not placed hydraulically, it will have to be worked mechanically. This could mean the use of heavy equipment such as bulldozers and payloaders. If the spoil is not properly consolidated and dewatered, this material will not support the required equipment, or low embankment of sand as it is advanced forward.

QUESTION: How long will it take for the spoils to stabilize before the cover can be applied?

ANSWER: The estimate for a 15-foot deposit of typical organic material might be from 6 months to a year where good drainage is available.

QUESTION: Can the in-place deposits support a sand cover? In other words, can the deposits as they exist now in Ticonderoga Bay support a sand cover?

ANSWER: The present in-place deposits can support a sand cover.

QUESTION: What depth of cover will they support?

ANSWER: It would be recommended to cover the outlying areas with at least one foot of sand cover and the areas that are extremely soft and loose (black sludge at mouth of creek) with two feet of cover to allow settling. If the sand cover is placed mechanically, however, a minimum of 3-foot cover is recommended to support the construction equipment necessary for the placement. Embankment heights must be limited to very low values to avoid mud waves.

Let me point out an area that is discussed in this answer. It says first the outlying areas with at least one foot. I interpret this to mean the area along the extremity of the major deposits which was referred to as that soft and loose sludge. That is the heavily concentrated area which is the area right in here.

QUESTION: What areas of the deposits are sufficiently consolidated so that they need not be removed?

ANSWER: It is believed that the outlying areas of Lake Champlain and the swamp areas along Ticonderoga Creek are sufficiently consolidated so that they need not be removed.

I would also like to point those out. Again, the outlying areas are the areas on the extremities of the major deposits. And the swamp areas are the swamp area in here which is covered by a very shallow depth of water and another swamp area which is northwest of the railroad tracks which goes approximately across here. And that is an area in here.

Mr. Chairman, that concludes my statement.

MR. STEIN: Thank you very much, Mr. Bromberg.

I think the Technical Committee has really done its work well. And on first reading here, this looks as if the facts are all there available for judgment one way or the other.

Are there any comments or questions?

MR. PAHREN: I have a few questions before the speaker sits down, Mr. Chairman.

Mr. Bromberg, are State and Federal water quality standards being violated at present in the Ticonderoga area of Lake Champlain in both Vermont and New York?

MR. BROMBERG: Yes, they are being violated.

MR. PAHREN: Which criteria are not being met?

MR. BROMBERG: Specifically, the dissolved oxygen criteria are not being met, the coliform criteria.

The fact that the sludge deposits exist themselves are a violation of the criteria, and the fact that the deposits generate a floating solid problem is also a violation of the criteria.

MR. PAHREN: Are these violations then related in any way to the sludge deposits that you spoke about?

MR. BROMBERG: Yes, I believe they are. First of all, the violations dealing with the floating solids are a direct result of the sludge deposits. The deposits themselves are organic in nature. And as they are decomposed in place, they generate gases within the deposit. And these gases cause solids to rise to the surface and float. So that is one contribution of the deposits themselves.

The second one is since the deposits are organic in nature, while they are being decomposed, the bacteria require oxygen from the overlying waters so that the deposits themselves can contribute to the violation of the dissolved oxygen criteria.

MR. PAHREN: In your opinion, will these violations of the criteria continue in the future if no corrective action is taken?

MR. BROMBERG: I would say, yes, they would continue.

MR. PAHREN: That is all the questions I have.

MR. STEIN: Are there any other comments or questions?

MR. EASTMAN: I have a question.

MR. STEIN: Yes, Mr. Eastman.

MR. EASTMAN: In your statement, that part which has the questions and the answers, with regard to the methods of containing the sludge, it is mentioned in the Corps' answer to question No. 1 that a clamshell dredge will create a greater disturbance with suspended solids than would a hydraulic dredge. And then subsequently, the distance is mentioned which the effect would take place for clamshell dredging and for hydraulic dredging. And I am wondering if the Corps indicated what that in effect is -- physical, chemical or what. Does it refer only to a physical effect with regard to suspended solids that would be stirred up, or does it also include an effect relative to return into solution of any material that might be in the sludge.

MR. BROMBERG: The answer which I read was a direct verbatim relation of the answer we got from the Corps. I can make an inference as to what I think this means. I think they are referring to the physical effect.

However, there are representatives from the Corps of Engineers here today. And I think if you were so inclined, they would provide answers to your questions if you have more detailed questions.

MR. STEIN: Are there any other comments or questions?

MR. PELOQUIN: I have two questions.

MR. STEIN: Yes, Mr. Peloquin.

MR. PELOQUIN: Mr. Bromberg, I wonder if you could refresh my memory. I am sure this has been covered before, but what bacterial concentrations are we talking about as far as the area in question?

MR. BROMBERG: The counts that were observed by us in the survey of 1968 were in the order of tens of thousands in the Ticonderoga Creek a day.

MR. PELOQUIN: Now, the hydraulic disposal of the spoils behind the dike area is the preferred method and the least expensive. I would assume some of the water entering spoil would have to occur before the sand cover could be put on or is it contemplated that the sand cover would be mixed hydraulically with the spoil?

MR. BROMBERG: No, I would expect the spoils would be dewatered first and dried to the maximum amount it is possible.

MR. PELOQUIN: Is there any indication of the time required for the dewatering since this is behind the dike? How would the dewatering process be accomplished?

MR. BROMBERG: I think the Corps in one of the answers I read does give an estimate for that. And I think it is in question 4.

MR. PELOQUIN: You are talking about the months for dewatering and depending on the drainage conditions. But if you are putting this behind the dike in an area that is now inundated, I think some provision would have to be made for removing the excess water from the spoil area.

MR. BROMBERG: I can only relate again what the Corps' answer was. And that was for a 15-foot deposit of a typical organic material that would take them six months to a year where good drainage is available. And I think that is the key to that answer.

But again, I would like to refer your question to the Corps because I think they could give you a more satisfactory answer based on their previous experience with dredging operations.

MR. PELOQUIN: Thank you.

MR. STEIN: Are there any other comments or questions?

MR. MILLER: Mr. Chairman, could I ask a question?

On the foot of page 7, it discusses the covering of the sludge with sand or loose gravel. In the opinion of your department, as an expert, will this cover have the effect of making the classification of these waters attainable?

MR. BROMBERG: To answer you honestly, I don't know. There have been studies done that investigated the effect of laboratory studies of putting a sand cover on deposits and evaluating the effect of doing that. But in the real situation, I don't think I could give you an answer as to whether it would or would not.

MR. MILLER: Mr. Chairman, we feel the same way.

MR. STEIN: O.K., let me ask you this because I think this raises a very interesting avenue: How about the other alternatives? Getting it out and putting it behind the dike, would that make the water quality attainable?

MR. BROMBERG: I think it would provided proper means were employed to control the discharge of the drainage water back out of the spoil area. I think it is feasible.

MR. STEIN: Well, we have had that problem, as you know, in the Great Lakes of putting spoil behind dikes. And I think we and the Corps feel we are pretty expert on this. But the question, if I understand your statement, with the alternatives you have, you are not sure that the covering in-place of sludge deposits with the sand blanket will produce the desirable water quality, but the other three methods of removing it to a disposal point somewhere else, you think would.

MR. BROMBERG: Yes. However, I would like to qualify. I don't believe that we would be in support of alternative No. 2 which suggests disposing of the spoils back into Lake Champlain.

MR. STEIN: I am sure we wouldn't either.

MR. BROMBERG: However, I think the other two which discuss physical removal of the sludge, yes.

MR. STEIN: All right.

Now, I would like to again just reserve this because I hope you are going to stay here for the whole conference, Mr. Bromberg. I hope this comes up later. But I just want to reserve this issue now.

It is a question. If you are going to remove the spoils, I think we have another factor that might have come up since the Corps and your Technical Committee did its work. And that is a question of the presence of heavy metals or toxic materials in this sludge bank. I don't know if it is there, and I don't know whether it isn't. But I think before we talk about disturbing the sludge bank, we better know what we are moving.

This is particularly true since we have had our mercury crisis in all parts of the country. And we find this very widespread.

I just want to reserve this. I would like the States and the others to indicate what the situation is that they have found and how we remove this and go toward meeting this problem.

Also, it might be helpful if an industry representative is here to indicate in his presentation whether the International Paper Company uses mercury in its process, and, if it doesn't, when it ceased, so that we can get a pretty good grip on this problem. Because, as you can see from the medical students' material that they dredged up, if we are going to fool with material like that and have a heavy metal toxic material, we better know what we are doing before we get into it. I think this will come out later.

Now, I would like to call your attention to the previous summary, which I am sure you have read. It says in the summary:

"The International Paper Company has requested a modification of the New York Health Commissioner's order involving the discharge from its Ticonderoga, New York, mill. This request for modification is based on the termination of all waste discharges by July 1, 1971. This request is presently under consideration by the New York State Department of Health. The International Paper Company has agreed to install waste treatment facilities at its new pulp and paper mill just north of Ticonderoga, New York. This plant is designed to remove at least 90 percent BOD and suspended, solids."

I think we can all take notice that this plant is under construction. I guess it is. I see it every time I fly over. But the question I have to ask is: Between now and 1971, to your knowledge, has the International Paper Company in Ticonderoga taken any action to reduce the wastes discharging into the waters?

MR. BROMBERG: Are you asking me a question, sir?

MR. STEIN: Yes.

MR. BROMBERG: To my knowledge, they have not. However, I think New York State might be in a better position to answer that.

MR. STEIN: In other words, to your knowledge, the discharge from the paper company is continuing into these waters right now unabated. And unless there is some kind of change -- and I don't know what it is -- this will continue until July 1, 1971?

MR. BROMBERG: Yes, sir.

MR. STEIN: All right.

Are there any further comments or questions?

MR. PAHREN: Just for purposes of clarification, perhaps Mr. Eastman can indicate whether that request was affirmed or denied that we just spoke about which would allow them to discharge until July 1971.

MR. EASTMAN: Well, to the best of my knowledge, the order was modified. And it is my understanding and the latest information that the company can, not only meet the terms of the order, but may be ahead of schedule with regard to meeting the terms of the order. But there will be a representative of the company here who will speak for the company.

MR. STEIN: I think we are just trying to get the factual situation. And the question is if the wastes from the company are going out and will be going out unabated until July 1971, I think we should all know that and consider that.

Well, thank you very much, Mr. Bromberg.

Are the Corps people here who want to answer these questions that Mr. Bromberg couldn't, or do you feel you can handle these now? Is that possible.

MR. GELBERMAN: I will try.

MR. STEIN: Why don't you come up, sir.

Stay up with him, Mr. Bromberg, and refresh his mind on the questions.

Introduce yourself.

MR. GELBERMAN: I am Jacob Gelberman, Chief of the Operations Division of the New York District.

Now, will you repeat the question?

MR. PELOQUIN: One question I had, sir, was the dewatering capability of the spoils placed behind the dike. About how long would it take to dewater that considering the fact that you would not have good drainage conditions in those conditions?

MR. GELBERMAN: Well, I believe the statement was if there were good drainage conditions, it would take a matter of 6 to 8 months.

MR. PELOQUIN: I think we can assume there would not be good drainage conditions if the spoil is placed behind the dike in that particular area.

MR. GELBERMAN: Well, that could be done by a series of baffle devices that would allow the top water to flow off. In other words, it isn't just a case of holding it all in place indefinitely. This could be drained and drained effectively through weir arrangements.

I believe the other question that you asked had to do with the dredging process wherein there is a certain amount of disturbance that takes place due to the mechanics and manipulations of the dredge. This is purely a mechanical stirring up of the material. And in most cases, it would probably have settled back within 24 to 36 hours.

MR. EASTMAN: May I ask a question?

MR. STEIN: Surely.

MR. EASTMAN: When you speak of a mechanical situation, you are referring to physical or suspended material?

MR. GELBERMAN: Physical. A hydraulic dredge has a cutter head device which rotates. But it digs into the material. This causes an aura of disturbance immediately at the digging device at the bottom.

MR. EASTMAN: Do you know whether there would be any effect insofar as material going back into solution as a result of this?

MR. GELBERMAN: No. In my opinion, except for perhaps some chemical dissemination I wouldn't be familiar with, anything that has any grain size, silt, would settle back out.

MR. EASTMAN: Suspended material?

MR. GELBERMAN: That's right.

MR. EASTMAN: But you indicated you don't know whether or not there would be any material that would go back into solution as a result of the dredging?

MR. GELBERMAN: No, I am not familiar with that process. That's about the best I can do with that question.

MR. EASTMAN: Thank you very much.

MR. STEIN: Let me check this because this may be an answer, at least approaching it, on the drainage. I think this has come up before. But as I understand our experience in the Great Lakes in putting spoil behind diked areas, the

Corps can by impervious dikes and a series of baffles drain the water off and provide good drainage. I think they could also provide the answer to the question of suspended materials staying behind the dike. That is pretty evident by what you see now.

Now, the question that Mr. Eastman had, and I think maybe, Mr. Peloquin, that may answer the question you have, as to the physical amount of drainage and the material in solution or the waters in solution going out through the dike, because, obviously, if you are going to have drainage, the water is going to go out, I don't know what the situation there is. Again, maybe the technical people want to evaluate this. That is the underlying assumption we have been proceeding on in the Great Lakes, and it seems to be working.

In the Great Lakes we have a lot more complicated industrial waste in the spoil than apparently we have here. We have oils, chemical plants, steel mill material; and, if you think that the contents of these bottles are bad, you should look at some of that.

But the notion is, by keeping all the suspended material out, and by letting the drained material in solution go out, that you are really in a sense not creating a material damage to the lake. This is working as an effective method of spoil disposal.

But I think this is something you might or someone might want to look into, or we might ask some chemists. I think this is a chemist's answer rather than anyone else's as to what is going to drain out of solution.

MR. GELBERMAN: I quite agree with that. I might point out to clarify what I have said as far as baffling and weir arrangements, the material that goes overboard, that flows from the area, finally can be practically pure water as far as visual.

MR. STEIN: Visual, that's right. I think Mr. Eastman's point is what remains in solution that we don't see. I know you do that job, and you do a very good job. The water draining out might look like this, but the question is if this water is disturbed and it has that dredged material, the sludge, around it, once you put it in and that drains off, is this water as pure as we might think?

The other argument is even before we had the baffle in here, this thing was in a free interchange with the lake water without making it any worse, certainly. But this is something that has to be worked out.

Thank you very much. You have been very helpful.

Do you have any more Federal people?

MR. PAHREN: No additional Federal people have indicated to me that they would like to make a statement, but I would like to ask anyone in the audience now is there any other Federal representative that would like to make a statement at this time?

(No response.)

If not, this concludes the Federal presentation, Mr. Stein.

MR. STEIN: Now, at this time, we have a request from Mr. Eastman of New York. He has someone he would like to call on because of previous commitments to make a statement now. We will call on Mr. Eastman, and then we will go back to the Vermont presentation and the Vermont calling of its invitees.

Mr. Eastman.

MR. EASTMAN: Mr. Roscoe Masterman, who is the Vice President of International Paper and General Manager of its Northern Division has asked for the opportunity to be heard as early as possible inasmuch as I understand he has a commitment just after lunch in Ticonderoga with regard to some urgent matters relative to management and employee relations. So in view of that, Mr. Masterman.

STATEMENT OF
ROSCOE MASTERMAN, VICE PRESIDENT
INTERNATIONAL PAPER COMPANY
GENERAL MANAGER, NORTHERN DIVISION

MR. MASTERMAN: Mr. Chairman, conferees, ladies and gentlemen, my name is Roscoe Masterman. I am a Vice President of International Paper Company and General Manager of its Northern Division.

At an earlier session of this conference, George Rand, also a vice president, reported on the company's plans for construction of a new mill to replace its present Ticonderoga mill. At that time he described in some detail the waste control facilities which are to be included in the new mill. I can report now that the construction of the new mill is well under way.

As the new mill is completed, operations of the present mill will be phased out. As Mr. Rand advised, we expect that the present mill will be completely shut down during 1971. At the current rate of progress of the work on the new mill, the pulping and bleaching operations at the present mill will be permanently discontinued before the end of 1970. You are aware, I am sure, that pulping and bleaching operations are the principal source of pollutants from a pulp and paper mill.

The waste control installation of the new mill represents a substantial investment. It should be one of the most modern and effective in existence in any commercial operation. The new mill's effluent will be at such quality as to be consistent with the quality standards for which Lake Champlain waters are classified.

Thank you.

MR. STEIN: Thank you, Mr. Masterman.

Are there any comments or questions?

MR. PAHREN: I have several questions, Mr. Stein.

Mr. Masterman, could you tell us for the record how long IPC has been operating its plant at Ticonderoga, New York?

MR. MASTERMAN: IP acquired the old Ticonderoga mill in 1925.

MR. PAHREN: Now, you mentioned in a general way your phaseout and phase-in procedures for the old and new mills respectively. One of the sections of the mill that I am interested in is the paper portion of your old mill. As you know, this mill generates quite a bit of fibers and clays, titanium dioxide, et cetera, which constitute a large portion of the sludge in Lake Champlain and Ticonderoga Creek. Could you go into more detail on phasing out this section of your mill?

MR. MASTERMAN: Well, of course, it is going to depend on how closely we meet our present target on starting up the new mill. We expect to curtail by about 50 percent our production of paper at the present mill in early 1971. And before the end of 1971, the balance would be terminated.

MR. PAHREN: Are you referring to December or your July 1 deadline?

MR. MASTERMAN: As you probably know, we are constructing a pulp mill and one paper machine at the new mill. As soon as that machine starts up and is operating reasonably well, we plan to shut down the largest of the 3 machines at the existing mill. That machine is going to be dismantled and moved to be re-erected at the new mill site and then started up.

So this is a rather unique operation in paper mill construction. We obviously are going to do it just as fast as we can. But it is a little hard to say just exactly how long it is going to take.

MR. PAHRENS: So you are saying for the next 6 to 8 months under your present plans, there will be no decrease in the waste load you are discharging to the waters?

MR. MASTERMAN: No, I am saying that in the fourth quarter of this year, we will be starting the pulp mill at the new site. And just as soon as that is running, the pulp mill at the old mill will be shut down.

MR. PAHREN: At the new site, can you tell us the distance between your effluent diffusers and the Vermont State line?

MR. MASTERMAN: I can't tell you the exact distance. I know the end of the diffusers is in New York State. And just how much it is, I am not exactly sure.

MR. PAHREN: Can one of your staff bring that out? Do you have the answer for the record?

MR. MASTERMAN: Mr. Arnold, do you know what that distance is?

MR. ARNOLD: Around 50.

MR. MASTERMAN: Around 50 feet, I would say.

MR. PAHREN: Fifty feet from the Vermont State line?

MR. MASTERMAN: That's right, sir.

MR. PAHREN: As you have indicated, you are going to meet all of the Vermont water quality standards 50 feet from your diffusers?

MR. MASTERMAN: Well, you are getting into some technicalities that I am not sure I have all of the exact answers. But basically, what we are saying is that the quality of our effluent should be such that the Vermont State quality standards will be met.

MR. PAHREN: We will be watching that extremely closely.

MR. MASTERMAN: I suspected that would be the case.

MR. PAHREN: Does International Paper have a company policy with respect to water and air pollution nationally?

MR. MASTERMAN: They certainly do.

MR. PAHREN: Can you tell us what that is?

MR. MASTERMAN: Well, if you like, I have with me the statement that Mr. Hinman made a short time ago when he announced the $101 million that we were going to spend in air and water pollution abatement.

MR. STEIN: They can put it into the record. Make your choice. Either read it or put it in the record.

MR. MASTERMAN: Why don't I put it in the record.

MR. STEIN: O.K.

(The above-mentioned statement follows.)

TO OUR SHAREHOLDERS:

This full-page advertisement announcing International Paper's $101 million plan to combat pollution has been carried by newspapers in major communities all across the United States as well as by several nationally circulated publications. In case you did not see this advertisement, we wanted to call it to your attention.

INTERNATIONAL PAPER ANNOUNCES A $101 MILLION, FOUR-YEAR PLAN TO COMBAT POLLUTION.

International Paper Company believes that the aspirations of our society for a better life can be met, that the pollution of our environment can be controlled, and that the vital quality of the basic resources we all share can be maintained within the framework of our economy. International Paper is dedicated to do its part as an industrial citizen to achieve these goals.

I can now report to you that the Company has adopted a four-year plan, to be completed by 1974. This plan places International Paper in the forefront of those taking positive, constructive measures to solve the problem of environmental quality.

We estimate the total cost of this program will be $101 million.

When this program is completed every one of our U.S. pulp and paper mills will be equipped with primary and secondary waste water treatment systems.

Water so treated does not adversely affect the complicated life chain in natural waters—from bacteria to plankton, to plants and fish life.

In terms of air quality this program will utilize the latest technology, which will permit us to remove over 99% of particulate matter from mill emission points. Presently installed equipment has an efficiency factor of about 90%. It will also include adaptation of new technical developments that will control the odors of a kraft paper mill.

International Paper pledges to apply its technology, its resources, and the efforts of its people to this end.

EDWARD B. HINMAN
President, International Paper Company

MR. PAHREN: Can you summarize in a couple of sentences the key provisions of that statement?

MR. MASTERMAN: Basically, it is over the next 4-year period, we are going to install primary and have installed primary and secondary equipment in all of our primary manufacturing facilities.

MR. PAHREN: Now, is the elimination of the continuing sludge nuisance in Ticonderoga Creek, in Lake Champlain, a part of this $101 million program?

MR. MASTERMAN: Would you say that again?

MR. PAHREN: I asked if the elimination of the continuing public nuisance in Ticonderoga Creek and Lake Champlain is part of this $101 million program of International Paper?

MR. MASTERMAN: I guess you are saying, in other words, in that $101 million are there provisions for removal of sludge?

MR. PAHREN: Yes.

MR. STEIN: That's what it sounds like to me.

MR. MASTERMAN: It is not so stated.

MR. STEIN: I don't understand the answer on that, I am sorry.

Let me try to rephrase it. Is the removal of the sludge included in your $101 million program?

MR. MASTERMAN: It is not so stated.

MR. STEIN: Right.

MR. PAHREN: Well, I am a little chagrined here. Isn't correction of damages from past pollution which continues to be a public nuisance and which is expected to be a nuisance in the future unless corrected just as important as upgrading your waste treatment facilities?

MR. MASTERMAN: Well, we are getting into a matter that is quite afield from what I was prepared to discuss. And you asked the question about if it was in the $101 million, and I said to the best of my knowledge it was not.

MR. PAHREN: Well, in your opinion as vice president of the company, can you not indicate to the conferees your opinion of the importance of eliminating this public nuisance?

MR. MASTERMAN: Well, as I said, the discussion of this was not part of my preparation for being here today. And I don't know that I would care to answer that question.

MR. HANSEN: May I ask a question?

MR. STEIN: Certainly.

MR. HANSEN: Is any part of that $101 million earmarked at all for remedial treatment at the present plant facility until such time as the new facility is open?

MR. MASTERMAN: I think not.

MR. HANSEN: Has the State of New York ordered International Paper to at any time especially in the last two years construct any treatment facilities for the present effluent discharge into Ticonderoga Creek?

MR. MASTERMAN: At the existing mill?

MR. HANSEN: Yes.

MR. MASTERMAN: Not to the best of my knowledge.

MR. HANSEN: You have no precise order from the State of New York in this respect?

MR. MASTERMAN: Not to my knowledge.

MR. HANSEN: And especially not since June of 1969 when the Secretary issued his recommendations?

MR. MASTERMAN: As I say, not to the best of my knowledge.

MR. HANSEN: Has your company conducted any independent studies concerning sludge removal or solving the sludge problem in Ticonderoga Bay?

MR. MASTERMAN: I believe not.

MR. HANSEN: Do you have any estimates at the present time of your daily volume discharge from the plant when it is operating?

MR. MASTERMAN: It is around -- don't hold me to it, but it is in the vicinity of -- 10 million gallons a day.

MR. HANSEN: Is this a reduction from the previous figures which indicated it was around 15 million gallons per day?

MR. MASTERMAN: As I said, don't hold me to the 10.

We have not installed major equipment. In the good operation of any pulp and paper mill, you are always trying to minimize effluent discharge. And we are continually working at that. And I can't tell you specifically what we have accomplished and what we have not.

MR. HANSEN: When the new facility is operating, do you anticipate any operation whatsoever of the old facility?

MR. MASTERMAN: Only as I have described earlier in the process of phase-in/phaseout. Once the new mill is fully operational, the old mill will be shut down.

MR. HANSEN: Is it your opinion that the old mill will be completely and forever shut down by July 1 of 1971?

MR. MASTERMAN: Well, forever is a long time. So I don't know that. But paper making as we are presently doing it at Ticonderoga will be terminated in 1971.

MR. STEIN: No, no; that wasn't the question. He said by July 1971.

MR. MASTERMAN: I am not sure about July. We have had some strikes. We have had some delays in our construction. Whether we meet July 1971, I would not care to promise at this point.

MR. HANSEN: Is it true that the water classification order of the State of New York would have required treatment at the existing facility by July 1 of this year?

MR. MASTERMAN: I wouldn't know of my own knowledge.

MR. HANSEN: And you are presently operating under a waiver from the State of New York?

MR. MASTERMAN: I can't say as to that.

MR. HANSEN: And from what I understand to be your previous statement, it would appear you intend to operate under a waiver from the State of New York until such time as a new plant is in complete operation?

MR. MASTERMAN: As I said, I wasn't commenting on the waiver. I described what our schedule is as we see it now.

MR. HANSEN: To your knowledge, in the past 10 years, has International Paper Company ever been ordered by the State of New York to install treatment at its present facility?

MR. MASTERMAN: We had a plan set up for the installation of effluent treatment systems at the existing mill. And then, of course, before those were started, we began construction of the new mill.

MR. HANSEN: I think one final question. Do you know of any passage of information, say, from your Regional District of your company to the head office of the company relative to the removal of the sludge or handling or solving of this problem following the conference which was held in November of 1968?

MR. MASTERMAN: I am not sure that --

MR. HANSEN: Was this matter brought up to the front office following the conference in 1968?

MR. MASTERMAN: Well, representation from the New York office was at the 1968 conference. So I am sure they have been informed about some of the results of the survey.

Is that answering your question?

MR. HANSEN: Yes.

Was the release of the $101 million environmental control program subsequent to the 1968 conference?

MR. MASTERMAN: Yes. The $101 million pollution control thing was announced at our annual meeting in May of this year.

MR. HANSEN: So in planning for this particular program, it would be fair to say that they were aware of this particular problem at Ticonderoga?

MR. MASTERMAN: That's probably a fair statement.

MR. STEIN: Any other comments or questions?

MR. EASTMAN: Yes.

I would like to correct for the record the matter of the order of New York State against the International Paper Company. It calls for a cease and desist of the polluting discharges at the existing plant on the date that is mentioned. And the method for accomplishing this is the construction and placing into operation of the new plant. The order applies to the polluting discharges from the existing plant.

MR. HANSEN: The date mentioned is July 1 of 1970?

MR. STEIN: 1971.

MR. EASTMAN: I think it is 1971.

MR. STEIN: Let me summarize this because I think it is significant. You may or may not consider it a significant point.

Reading from the previous conference in 1968, the modification was based on the termination of all wastes by July 1, 1971. Presumably, that is recommendation 5 on the first conference.

New York has issued an order presumably granting this and asking for termination of the wastes. According to the statement of Mr. Masterman, we do not have the assurance that the old mill will be completely shut down by July 1971. But he says they expect the mill will be completely shut down during 1971.

In other words, I think it is a fair assumption from this statement that we may be expecting discharges from the mill after July 1971, and it may even extend into 1972 if their target date isn't met. But certainly they are not assuring July 1971 as a termination now.

MR. HANSEN: Mr. Chairman, I believe in asking the question, I was referring to paragraph 5 of the summary where they stated that the schedules called for construction of remedial facilities by 1970 with the following exceptions. And I note that the International Paper plant is not listed as one of the exceptions.

MR. STEIN: That is correct. And they asked for a modification from New York State. New York State gave them the modification. That was 6 months to July 1971. This would be an extension of 6 months that New York gave them. And the industry has come in now and has indicated that they are not giving assurance that July 1st date will be met, but it may be another 6 more months.

MR. HANSEN: Just so I understand it, and I may have raised a question and don't understand it myself, are we operating under the idea here that no order was ever issued for treatment at the present facility?

MR. STEIN: No.

We will let Mr. Eastman speak. They ordered them to cease and desist pollution of discharges from the existing facility by July 1, 1971. This was predicated on the notion that this would be shut down and International Paper Company would be operating in a new facility.

But their order did not go into terms of treatment to the old facility. They just told them to cease and desist by this date. And evidently the industry is going somewhat beyond that date by its statement.

MR. PAHREN: Let me make a comment here, Mr. Stein. It is my understanding that New York did issue an order to International Paper Company to complete construction at Ticonderoga by July 1, 1970. And this particular date is what was submitted to the Secretary of the Interior for approval in the official water quality standards for that particular pollution source.

Therefore, July 1, 1970, is the official Federal water quality standards completion date for eliminating the pollution at Ticonderoga.

MR. STEIN: Are you sure of that? I just want to get the facts. Is that July 1970, again? Our conference says by 1970. And this to me means December -- up to December, anyway.

Are you sure it is July they put in?

MR. PAHREN: Our records show 7/1/70.

MR. STEIN: Well, all right.

Are there any other comments?

MR. PAHREN: I have additional comments.

MR. EASTMAN: Excuse me. If I may interrupt because I just want to point out that New York State does not assume that International Paper is not going to meet the terms of its order. New York, on the contrary, fully expects International Paper to meet the terms of its order.

I can't speak for anybody else with regard to assumptions, but I can only speak for New York State.

MR. STEIN: We understand that,except that the only thing I pointed out is that the statement of Mr. Masterman indicates that they will not completely shut down the mill until 1971. And that is not an absolute assurance. That may go to December, and that may be after the order. I am not assuming a default either, but there is no assurance in the statement that we have gotten from International Paper that they are going to meet the July 1st deadline.

As a matter of fact, there is a statement here that they expect to use the end of the year as their target date.

Are there any other comments or questions?

MR. MILLER: Yes, I would like to move back to Mr. Masterman's statement, if I could, Mr. Stein.

The final sentence says, "The new mill's effluent will be at such quality as to be consistent with the quality standards for which Lake Champlain waters are classified." I would be more satisfied with this statement if it included the words, "and in such quantities." The quality by itself, considering the very large quantities of material to be discharged, we have doubts as to whether in those quantities they will be consistent with our standards, at least.

MR. PAHREN: I have a few more questions, Mr. Masterman.

Is there any reason that part of the $101 million that you have earmarked cannot be diverted to eliminate this public nuisance in Lake Champlain?

MR. MASTERMAN: Well, you already asked me if part of it was earmarked for that, and I said to the best of my knowledge it wasn't. I mean just by the virtue of its being $101 million, the whole is made up of a whole lot of pieces. And to the best of my knowledge, that was not one of the pieces.

MR. PAHREN: Well, my question now is in terms of priority -- whether elimination of this public nuisance can be given a higher priority than zero, which apparently was your previous priority, and recognizing that something at the bottom of the priority list may have to suffer.

MR. MASTERMAN: Well, I would say that that decision would be up to a higher echelon of the company than I am myself.

MR. PAHREN: Theoretically, though, this is a possibility?

MR. MASTERMAN: I guess theoretically, almost anything would be a possibility.

MR. PAHREN: O.K.

Now, let me change the course a little bit here. In the new mill, will you have any bleaching operations?

MR. MASTERMAN: We will.

MR. PAHREN: Will you use chlorine as a bleach?

MR. MASTERMAN: Yes.

MR. PAHREN: Will you generate the chlorine on the premise or buy it?

MR. MASTERMAN: We buy it.

MR. PAHREN: Have you ever generated chlorine at your existing mill or have you always bought it?

MR. MASTERMAN: To the best of my knowledge, we have always bought it. I don't believe we have ever generated chlorine there.

MR. PAHREN: Have you ever used mercury slimicides at the existing mill in the past?

MR. MASTERMAN: Yes.

MR. PAHREN: How long ago?

First of all, do you use them at present?

MR. MASTERMAN: No, we haven't used them since early 1966.

MR. PAHREN: So for the past 4 years you have used other than mercury slimicide?

MR. MASTERMAN: Four years plus.

MR. PAHREN: Have you ever checked whether as a result of your use of this prior to 1966 any of it is contained in the sludge deposits below your mill?

MR. MASTERMAN: We have not tested the collection of mercury there.

MR. PAHREN: That's all the questions I have at this time.

MR. STEIN: Have you ever used mercury in your process other than the slimicides at your old mill?

MR. MASTERMAN: No.

MR. STEIN: I didn't want to interrupt.

Now, let me try this business, and this fascinates me because, as you know, we have a lot of "clients" in the pulp and paper companies, and the movement of the mill such as you are doing is a kind of unique situation. Are you going to have to move your pulp back and forth between those two mills while you are moving your paper plants?

MR. MASTERMAN: As soon as the new mill is in operation -- in fact, at the present time, we are installing 2 Cameo wet machines which will dewater pulp at the new mill so that we can track it in latent form to the old mill to run the 2 paper machines.

MR. STEIN: But what I am getting at is the first priority treatment at the new mill, pulping at the new mill? In other words, are you going to be transporting any pulp from the old mill to the new mill for processing in a paper machine?

MR. MASTERMAN: No.

MR. STEIN: As soon as you open the new mill with the first paper machine, your pulping operation will be operating from your new mill?

MR. MASTERMAN: Right.

MR. STEIN: And any pulp you move to a paper machine will be moving from your new mill to the paper machines in the old mill?

MR. MASTERMAN: Right.

Of course, the machine at the new mill is going to be operating pulp.

MR. STEIN: Oh, sure. It seemed to me the sensible procedure, but I just wanted to clarify it.

MR. MASTERMAN: We will be moving pulp from the new mill to the old mill, right, sir.

MR. STEIN: I wanted to clarify that in my own mind.

I again think that International Paper -- I hope you do it -- has a lot of confidence in putting the end of a disposal line 50 feet from another State line, but maybe you also have a lot of confidence in the Corps.

MR. GELBERMAN: I think it is probably 50 feet deep. I don't believe it is 50 feet from the --

MR. MASTERMAN: Oh, no. I don't think it is 50. I don't think the lake is 50 feet deep there.

MR. STEIN: You must have a lot of confidence in your process to do that. But I guess a firm that can announce $101 million pollution abatement program and not provide for taking up the sludge has a lot of confidence in their program anyway.

MR. MASTERMAN: We think we have the best in the business.

MR. STEIN: Are there any other comments or questions?

(No response.)

If not, thank you very much.

MR. MASTERMAN: Thank you, sir.

MR. STEIN: We will call on Vermont now for its statement.

MR. MILLER: Thank you, Mr. Stein.

I would like to call on Peter S. Paine, Jr., General Counsel for the Lake Champlain Committee, Willsboro, New York.

STATEMENT OF
WILLIAM S. COWLES, JR.
VERMONT CHAIRMAN, LAKE CHAMPLAIN COMMITTEE

MR. COWLES: Mr. Chairman, conferees, ladies and gentlemen, my name is William Cowles, and I am the Vermont Chairman of the Lake Champlain Committee which has a membership of over 1500 people distributed through the Lake Champlain Basin on both the Vermont and New York side. Mr. Peter Paine of Willsboro, New York, who is general counsel for the committee, will present the position of the committee with regard to the specific issue of sludge in Ticonderoga Bay and the general issues of water quality of Lake Champlain.

My sole purpose at this time is to place in evidence petitions collected by the Lake Champlain Committee and particularly Mr. Maguire who resides in Shoreham, directly across the lake from Ticonderoga, bearing the names of 572 residents of the towns of Bridport, Shoreham, Cornwall and Middlebury. These petitions were circulated during a period of 10 days just recently. And the number of people who volunteered to sign them must represent something well over 10 percent of the residents of the towns across Lake Champlain from the International Paper Company plant at Ticonderoga.

Mr. Chairman, they represent a deep deposit of resentment and ill-feeling against the abuse of the air and water of Vermont by the paper plant which can only be removed by the removal of the deposit of sludge and the future operation of any paper plant on the lake so as not to degrade our air and water.

Therefore, I will now introduce Mr. Paine who will present the statement of Lake Champlain Committee.

MR. STEIN: These petitions will be accepted as an exhibit.

(The above-mentioned petitions marked Exhibit No. 1 are on file Headquarters FWQA, Washington, D.C., and the Regional Office, Boston, Mass.)

STATEMENT OF
PETER S. PAINE, JR., GENERAL COUNSEL
LAKE CHAMPLAIN COMMITTEE
WILLSBORO, NEW YORK

MR. PAINE: Gentlemen, I think perhaps this little sign on the podium (sticking a sign on the podium) may have some bearing on our discussions today, Mr. Chairman, with your permission.

I am Peter Paine, General Counsel of the Lake Champlain --

MR. STEIN: What does it say?

MR. PAINE: It says, "Don't do it in the lake." And I hope our friends from IP and others who pollute the lake will keep it in mind.

MR. STEIN: I hope you will permit me an aside here because I would like to ask the rest of the people to do this. We are really producing material for a record. And signs don't show up on the record when we produce it in black and white. And when you point to a map and you say, "It is the red portion," or you say, "It is going to start here," without a descriptive term, when someone reads that, it is not very effective. So I ask you all to try to keep that in mind because we would like a record. I think your effectiveness will show through the record as well as your presentation here.

MR. PAINE: I will say for the record I have placed on the podium a sign which has come from Lake Michigan, sir, and it has been donated to the Lake Champlain Committee that says, "Don't do it in the lake."

I appeared at the conference in 1968 on behalf of the Lake Champlain Committee at which you, Mr. Stein, I think, were unable, unfortunately, to be present due to the bad weather. And I have today a prepared statement with respect to the position of this committee which is the major citizens group in both New York and Vermont concerned with the elimination of pollution from Lake Champlain.

However, before I make this statement, I have a couple of comments and one or two questions I would like to ask. I realize the format of this conference means that I may not get an immediate direct answer to these questions, but I hope you will --

MR. STEIN: No, any participant can ask questions of the panel or anyone else. We don't force anyone to answer.

I do ask one thing, and we have had a large experience in this. If you are asking questions which you don't believe are rhetorical questions and you want to put forward for a forensic or hortatory approach, I would appreciate if you would ask the questions one at a time so we can supply the answers.

MR. PAINE: Thank you, sir. I have that very much in mind.

I would like to ask really two basic questions for clarification in my own mind. One to Mr. Bromberg, and it is essentially this: It is my understanding from his earlier statement and from the questions from the panel that the sludge deposits at Ticonderoga Bay will continue to be a substantial source of pollution to Lake Champlain after the shutdown of the old mill at Ticonderoga.

MR. STEIN: Mr. Bromberg.

MR. PAINE: Mr. Bromberg, is that true? Is that the thrust of your reply to one of these questions here?

MR. BROMBERG: I think I said, yes, that they will contribute to the degradation of quality.

MR. PAINE: Do we have any idea as to how long, if they are not dealt with in some manner, this process of gasification and disintegration and so forth and so on will continue? After the shutdown of the mill? Some after the time of no new addition to this deposit?

MR. BROMBERG: I don't think I could estimate how long they would continue, let's say, to cause a problem. I would say that their effect would decrease over time. But as to how long it would take for that decrease to go to zero, that, I cannot estimate.

MR. PAINE: Is it 6 months or 2 years or 5 years?

MR. BROMBERG: I would think we would be talking in the neighborhood of years.

MR. PAINE: Years rather than months?

MR. BROMBERG: Yes.

MR. PAINE: That was my first question, sir. My second question relates specifically to an issue that was raised at the earlier conference and which I will come back to a little later.

Thank you, Mr. Bromberg. I thought that was what you meant, but I wanted to be certain. And it is particularly germane in view of the fact that the discharge pipe of the Ticonderoga mill, the new mill, now appears to be 50 feet from the State line.

I would like to ask the gentlemen from Ticonderoga -- well, let me back up. In the recommendations of the conference in 1968, sir, so far as thermal pollution criteria were concerned, the conference stated that "The temperature of the epilimnion shall not be raised more than 3° F. above that which existed before the addition of heat of artificial origin." I am quoting from page IX or subparagraph (b) of Recommendation 1 of the Federal presentation at that time.

It is my understanding, Mr. Miller, that the 3° standard is the current of the criteria.

I would like to ask the gentleman from Ticonderoga, Mr. Masterman, if he believes that the effluent from the new mill will meet this 3° thermal pollution standard at the State line.

MR. CARROLL: For the reasons indicated earlier, Mr. Masterman has had to leave, and he is not here.

MR. STEIN: When you get up, we need your name for the record.

MR. CARROLL: Paul Carroll, C-a-r-r-o-l-l. I am an officer of International Paper.

MR. PAINE: Is there anybody from the International Paper Company who is technically qualified to answer this question here in the room?

(No response.)

MR. STEIN: Well, that is a requirement of the conference, isn't it, sir, that the standards of --

MR. EASTMAN: May I comment on this?

MR. STEIN: Yes, sure.

MR. EASTMAN: New York's thermal criteria require no more than 3° increase as a result of introduction of discharges of artificial origin.

And insofar as the disposal is concerned at the new plant, the facility has been reviewed and granted a construction permit by New York and on the basis of its ability to meet New York's criteria.

MR. PAINE: So is the consensus of the technical people in the State of New York that the New York standard will be met?

MR. EASTMAN: I don't know what you mean by consensus. That is the basis on which people who review such plans concluded that. But not all of the technical people in the State of New York had access.

MR. STEIN: I believe we have some further comment from Vermont on this. Someone said in this field the trouble is you are building a plant, and we are moving so fast, we move at these standards like a moving target, and we never stand still. The kind of thing we were asking for 10 years ago, primary treatment, is out. We are asking for secondary and a lot beyond. And I think we may be in the same position in temperature.

I wonder if we could hear from Vermont.

MR. MILLER: For the record, Mr. Chairman, and in reply to Mr. Paine's question, the Vermont Water Resources Board upon the recommendation of the Department has submitted to the Department of the Interior a new set of standards for interstate waters. In those submitted standards, we would like to see no elevation of temperature without special approval from the Water Resources Board and in no event more than 1° elevation. And this would only be for extreme cases such as cleaning water blowdown and this kind of thing.

We have not yet heard from its being reviewed in Washington. And as soon as we hear, the standard will be promulgated and a hearing will be held for objection. But I think the position of our Water Resources Board with the full support of our Department is that in a closed body of water such as Lake Champlain, the addition of heat in any large quantities is in fact adverse to habitat of fish, increases algae bloom, encourages the aging of the lake in so-called eutrophication and is, therefore, clearly polluting. And we trust in due course, if proper wording can be agreed upon, that will be the force and thrust of our determination.

MR. PAINE: Thank you, Mr. Miller.

MR. STEIN: Thank you.

I think this is such an important question, let me try to throw some light on this and clarify it.

The provision you read, temperature of the epilimnion shall not be raised more than 3° F. above that which existed before the addition of heat of artificial origin -- it was a recommendation made by the Federal field staff now, but at that time was not accepted by the conferees. Since then, several things have happened. New York, as you know, has been using, as Mr. Eastman says, 3°.

In addition to that, we have a guideline that has been used in the Federal establishment that somebody popularly called the "green book", but was put together by a group of eminent biologists. And generally they talk in terms for a warm-water fishery in the river of a rise of no more than 5° F. and no more than 3° F. in estuaries. And then we have limitations, and some of these people want limitations, on the maximum temperatures you can have in your lake at one time.

In other words, a lot of the biologists feel it is not just enough to have a limitation on the top and a rise, but they want maximum, too.

Now, you also have come up with your sign from Lake Michigan. I would like to just put out as a factual statement what I was directed to say at our Lake Michigan conference. I was directed to say this by the Assistant Secretary for Water Quality and Research Carl L. Klein and the Assistant Secretary for Fish, Wildlife and Parks Leslie L. Glasgow. They said that temperature rises would be held to the minimum, that we would not permit a temperature rise of more than 1° F. over ambient, and that this would preclude the necessity for mixing zones.

I think if I understand the Vermont proposal, it is very close to this statement that I was directed to make at the Lake Michigan conference. I would suspect that it is more stringent than the temperature restrictions presently enforced in most of the States.

Does that answer your question?

MR. PAINE: Thank you, Mr. Stein. It does, indeed, sir.

MR. EASTMAN: Excuse me. May I, Mr. Chairman?

MR. STEIN: Yes.

MR. EASTMAN: I would like to clarify. Is it correct, as Mr. Paine said, that Vermont's criteria relative to temperature standards is now no more than 3° rise?

MR. ALBERT: Yes.

MR. EASTMAN: Which is identical with New York.

MR. ALBERT: Yes.

MR. EASTMAN: Thank you.

MR. PAINE: Mr. Chairman, I will come back, if I may, to this thermal pollution matter. I would like to just say one thing. I am sympathetic to the problems of the paper industry. My father is a chief executive officer of a major paper company in the State of Maine. I have worked in paper mills. I know a great deal about the paper-making process.

I also know something in the industry scuttlebutt about the problems that IP is facing with respect to the sludge deposits at Ticonderoga. I think I can say on the basis of pretty good information that they regard this as a test case. If they are compelled to shell out their own money to clean up this mess, it is going to have very unfortunate repercussions for them all over the country.

And there are some interesting legal questions involved as to whether or not they can be compelled to spend their money to clean up the mess that as a result of the Engineers' report has confirmed what we all along knew, which is that 90 percent of this stuff came out of the IP mill.

In the 1968 conference, Mr. Chairman, I asked Mr. Rand whether or not his company was prepared to spend any money to clean up this mess. And needless to say, he was unwilling to answer that question. I note again today that in spite of $101 million program announced with so much bally-hoo in the papers -- full-page ads in the New York Times are expensive and so forth -- that no part of that sum has been earmarked for the removal of these sludge deposits in Lake Champlain. And I think I can assure you that the International Paper Company will do everything it possibly can to avoid spending one penny of its money in that removal process short of being legally compelled to do so.

The position of this committee with respect to the sludge deposits is today what it was in 1968. We feel they should be removed. We believe on the basis of the evidence that we have heard thus far that the most satisfactory solution is probably the land reclamation project that was discussed earlier.

We are, however, aware, sir, of the recent information with respect to mercury residues. And we like yourself would like to know what we are doing before we embark upon this particular project. But it seems to us that this is the most satisfactory one from a number of standpoints with this caveat about the chemical and possible environmental effects of releasing mercury and possibly other chemicals that are in the sludge. And we hope that the technical committee -- and I understand the New York State Conservation Department is in the process of doing analyses or the Pure Waters Department of Health --

MR. STEIN: We will be discussing that in this conference, and I hope we will set up a procedure where we are going to have a very rapid evaluation of the mercury or nonexistence of mercury in that sludge bank. Because whatever is done with it, I think we have to know that as a basis for future action.

MR. PAINE: Precisely, sir. Well, we completely concur with that.

Our view with respect to the alternate suggested by the Engineers is as follows:

If the dredging isn't satisfactory, then the sand cover might be an alternative. But I am not personally very optimistic about it, and I gather Mr. Bromberg is not either.

We would be totally and utterly opposed to the concept of any deep water disposal. Indeed, it is a curious reflection on the state of the mind of the Engineers they could even seriously consider it in 1970. However, I realize that times change, as you said, and these criteria.

MR. STEIN: You got that sign from Lake

Michigan, but you were not up there. That is one of my big problems.

Let me seriously consider it. We are doing it all the time.

MR. PAINE: I know, but let's not take the crap from one part of the lake and dump it into the other part of the lake. That doesn't make any sense at all. So I think our position, sir, with respect to the sludge deposits is pretty clear.

And as I said in 1968, we would like to see some Federal money put into this. We would like to see some New York State money put into this. And we would like to see International Paper Company come up with some money because they are the people responsible for it in the first place. And if all this dilly-dallying goes on much longer, I am beginning to wonder whether a citizens' lawsuit isn't the best way to get them to do something.

The courts today are sometimes being very, very helpful to conservationists, and I will give serious consideration to suing IP on behalf of the Lake Champlain Committee if we don't get a little bit more action out of them.

So far as other aspects that are of concern before this conference, sir, I understand from a news release and from the correspondence that we have had earlier that there are certain other standards that you will be considering. I don't want to take very much time from the conference today, but I would like to mention very briefly four points that we hope to submit for your recommendation which I imagine you will take up in executive session.

The first of these is that the dumping-of-spoil ban that is to be applied to the Great Lakes should be applied to Lake Champlain and no deep water disposal of dredging.

The second is that your policy with respect to the 1° standard for thermal pollution in Lake Michigan should be specifically applied to Lake Champlain.

The third is that with respect to thermal pollution criteria, the recommendation of the report of the National Technical Advisory Committee to the Secretary of the Interior that the hypolimnion -- that is, the lower layer -- of lakes containing salmonoids and other cold-water fish should not be used as a source for removal or discharge of water used for cooling purposes, this should be made expressly applicable to Lake Champlain.

And I note, sir, that in 1968, the recommendations of the Federal authorities to the conference did not expressly make this recommendation, though Dr. Tarzwell in his oral presentation did seem to indicate this was desirable. We would like to see this established as a matter of firm policy.

P. S. Paine, Jr.

Fourthly, we would like to see a principle of nondegradation of the waters of Lake Champlain applied. And I understand that it is now a policy of both the State of Vermont and Mr. Eastman's State of New York--a recent administrative policy.

And, finally, and in many ways most important, we would like to see you give some high priority to a program for the development of economic and feasible methods for nutrient stripping of sewage effluent sponsored by the Federal Government. This target should be effective nutrient removal by 1975 for effluent discharged into waterways in the shallow portions of the lake -- south end, Mallets, St. Albans, Mississquoi Bays and also Cumberland Bay.

I think we ought to be aware of the fact that all of the money being spent on the secondary treatment, sir, on these deadlines that are never met and none of them are going to be so far as 1970 is concerned, are simply not going to be adequate to deal with the very serious eutrophication problems we now have in the lake, particularly in these isolated bays.

And lastly, we would like to see the implementation of the proposal of the National Commission on Marine Science, the so-called Stratton Commission, to make a pilot technological study of lake pollution to guide restoration of the Great Lakes, using Lake Champlain as a model.

And that concludes my statement, sir. And we are very pleased to have you here.

We note that the lake continues to be polluted while we all deliberate, and we think that is a pretty sorry mess. And we would like to see something done about it.

MR. STEIN: Thank you, Mr. Paine.

Are there any comments?

MR. MILLER: Just one.

Peter, in your point 6, you say for nutrient stripping of sewage effluent. Why do you limit it to sewage?

MR. PAINE: I don't. I am sorry, Denning. That is not a typographical error, but just a drafting error. I don't see any reason why distinction should be made between sewage and industrial effluent. Our major problem so far at the moment, at least, is sewage, but cheese plants and other things obviously come into it.

I might make one other comment in this area. You have got here a very compact drainage basin -- one that is well defined and with a relatively modest population. How about Lake Champlain drainage basin as a target for the banning of the sale or use of detergents containing phosphates just to see what would happen? This would be a very interesting control. And I think it could be done.

MR. STEIN: You do?

MR. PAINE: Yes. I think the Legislature of Vermont would pass a bill to that effect in the next couple of years.

MR. STEIN: I know, but how would you do this? Let us stay here a moment. Because if you say something like this, then more and more people are going to be asking for product control. But if the people are going to be able to get the product and you are not going to be able to go up to that summer cabin, or watch that lady in Apartment 4B, or the one in Room 302 of this hotel wash out her stockings, then how are you going to determine whether you are going to have a phosphate-laden detergent used by these people if you don't have a real broad nationwide ban instead of doing it on a discrete river basin basis?

I don't know that we have to answer it here. In dealing with the population that we have and the type of Government we are and the rights of privacy of our citizens, I find the problem in that kind of discrete product control makes solutions something very hard to assure.

MR. PAINE: I am sensitive to the enforcement difficulties, but I would point out to you, sir, a bill very nearly got through the New York State Legislature this session with respect to the use of detergents within the Lake George drainage basin. And we in New York have found that Lake George is always a step ahead of most of the other bodies of water in the lake because of the very special quality of the water and the very special legal and sort of ethical attitude towards that lake.

I would suspect that such a bill will be passed within the next year, and there is a lot of enthusiasm for it in the New York side of the lake. I think you could do it, and I think the people of Vermont would be prepared to do it.

The answer is if you can't buy it at the grocery store, you are going to have to look to some alternative, and there are alternatives. I have a bottle of the stuff that is now on the market down in our office in Shelburne. So I think it can be done, and I think you may be able to accomplish it here long before you could on a nationwide basis.

MR. STEIN: That might be. And let me just point out one fact because I have done this before. We know we can get a reduction in phosphates if we eliminate detergents. And as a matter of fact, our Administration has come out for a substitute for phosphates in detergents as rapidly as possible.

However -- and this is what I want to point out -- this is not a panacea. We estimate that about 3.5 pounds of phosphates are produced per capita in this country. Our Federal scientists tell us two-thirds of this probably comes from detergents -- soap and detergents -- while scientists put this the other way around, saying only one-third. Maybe you want to split the difference. Maybe you don't.

But the point is even if we had the magic wands and we could eliminate those detergents now, we are not going to eliminate the phosphate problem. Maybe you will in Lake Champlain, but are you preserving the waters in Lake George? I would have hoped you would have done as well with the land around the waters, but whenever I drive by there, I notice that you are getting a lot of people. Just the human wastes produce a tremendous amount of phosphates as well as other nutrients.

In other words, if we are going to permit these concentrations of people around lakes, we are going to have a nutrient problem anyway, and we have to take care of that whatever we do with detergents. This should be understood because sometimes we get so wrapped up in this, you think if we are going to solve the detergent problem, we have the nutrient problem solved, and that is just not so.

MR. PAINE: You notice I said nutrient stripping and the detergents. But I would not like any of these additional comments to detract your attention, sir, or the attention of the people in this room from the fact that the sludge removal is the number one item on this agenda, and we would like to see something done about it.

Thank you.

MR. EASTMAN: Mr. Chairman, I would like to correct what I think was an implication, perhaps not intended, but I know it is currently fashionable for lawyers to take pot shots at engineers. But there are no engineers associated with the Division of Pure Waters in New York State that have proposed the removal of the sludge from Lake Champlain and dumping it elsewhere in Lake Champlain. Nor, for that matter, are there any lawyers associated with the Division of Pure Waters that proposed such a step.

MR. PAINE: I didn't mean to suggest that, sir. It was in the Army Engineers report, as you well know.

MR. EASTMAN: Since the Army Engineers are a part of the Army, I think they are probably perfectly able to defend themselves.

MR. PAINE: I didn't mean to cast any aspersions on your department, sir.

MR. EASTMAN: Thank you.

MR. STEIN: Well, I would like to again thank you very much for your statement, Mr. Paine. I think you have raised a couple of issues, and I think one of the key ones you raised which may not have been called to a lot of people's attention is that when we are dealing with a lake and you are dealing with the deterioration of water quality, you may be having a different situation than you have in a river or an estuary. In a river or an estuary, if you clean up the pollution, given the spring freshlets and sweeps of the tides, it may be as good as new.

But in a lake -- and this applies to Lake Champlain as well as any --- they are subject to that aging eutrophication process. And once the lake goes downhill, there is no assurance it can ever come back. I think Mr. Paine's point is well taken that every day of pollution, it may be that water quality in Lake Champlain is lost forever.

Also, I think that's why we may have to look at the stirring up of this sludge material very carefully, because if this is going to present a problem, we have to recognize what it is going to do in the lake. Before we close that, I would like to indicate what I think possibly is happening in several industries, and Mr. Paine alluded to this too.

Whether the industry is responsible for removing sludge deposits or not, I think again this primarily is, I would suspect, a problem initially we are going to have to work out with New York State and hopefully under the New York State authority on a lot of these precedent-making issues. Industry is kind of meeting this with a legal challenge, and you can never tell where a legal case is going to go.

When we asked the Florida Power & Light Company in one of our cases not to put out heated water or build a channel, they refused to accept this. The Government felt obliged to go to court for a preliminary injunction. The Federal Government was licked, and on the preliminary injunction! But we go to trial presumably in September to see if we can get a permanent injunction. The issue in September -- and I am delighted to see it come up -- is whether the discharge of heated water is going to constitute pollution under Section 13 of the River and Harbors Act.

Now, if that is the kind of decision that the industry wants to go to court to and not come up with a negotiated solution, I am delighted. The lawyer for them has indicated that, of course, seeing this precedent value, he is ready to go to the Supreme Court with this.

Speaking for myself, and I think the Government lawyers, so are we -- we would be delighted.

Now, the question is if you are talking about a precedent-making case and you want to do this through the courts as to who is responsible for removing spoil, sludge material that is creating a pollution problem, it boils down to not having a negotiated solution. But if any industry wants to achieve distinction within its trade association and make itself the test case, I think we need a little more law on the subject, myself.

We will stand recessed for lunch until 1:30.

P. S. Paine, Jr.

(Whereupon, at 11:55 o'clock a.m., the meeting recessed, to reconvene at 1:30 p.m. the same day.)

AFTERNOON SESSION

1:35 p.m.

MR. STEIN: Let's reconvene.

Let's call on Vermont again. Mr. Miller.

MR. MILLER: My list seems to have disappeared.

MR. STEIN: Here it is. I think it was appropriated across the lake.

MR. MILLER: Well, they are very welcome to it.

We call Mr. R. A. Willis, Executive Director of the Addison County Regional Planning Association -- he also wears a couple of other hats which he will explain to us -- for a brief statement.

Mr. Willis.

STATEMENT OF
R. A. WILLIS, EXECUTIVE DIRECTOR
ADDISON COUNTY REGIONAL PLANNING
MIDDLEBURY, VERMONT

MR. WILLIS: Thank you.

Mr. Chairman, conferees, ladies and gentlemen, the remarks I have to make I would hope would be indicative of these groups of people that I am directly connected with an represent in passing.

First off, I am Executive Director for the Addison

County Regional Planning Commission that has 5 towns bordering Lake Champlain in the area that is under discussion.

Secondly, I am president of the Vermont Federation of Sportsmen's Clubs with a membership representation of close to 100,000 license holders in the State of Vermont.

Thirdly, I am a trustee of the new environmental center in Ripley which has been newly established and will conduct studies relative to the environment in the State of Vermont.

From these various aspects, I am sure that the environmental center will conduct and will be vitally interested in the outcome of this conference relative to environmental control in the Lake Champlain area.

Secondly, the Vermont Federation of Sportsmen is vitally interested in the fish and wildlife habitat in Lake Champlain and its adjoining marshes for waterfowl refuge and so forth.

Back to the Addison County Regional Planning Commission, we are attempting to plan for the future.

From this background, I would like to present to you this following statement:

Addison County with its Towns of Orwell, Shoreham, Bridport, Addison, Panton and Vergennes, bordering on Lake Champlain, is vitally interested in the absolishment of pollution in that lake.

This concern is not only addressed to the fact that for the past 25 years or more, these towns have been subjected not only to an air pollution problem but also to an increased decline in water quality along their respective shorelines. This is brought about by the apparent lack of proper controls over the operation of the paper mill at Ticonderoga over a period of time, which has resulted in the build-up of a hug sludge deposit, the disposition of which is now under consideration.

It is with these facts in mind that the ACRPC and the Federation of Sportsmen respectfully requests that the Department of the Interior exert every effort possible to effect a realistic program that will not only eliminate the present existing problems brought about by actions of the past, but also a program that will insure for the future an air and water quality guaranteed at its highest attainable level.

We believe that this can be brought to reality by:

1. The establishment of standards applicable to both New York and Vermont governing the quality of discharge into Lake Champlain from any source whether it be private, commercial, municipal or industrial. Population and industrial growth along with recreational resources of the

Champlain Valley, which are an important economic asset to the area, must be considered as a whole. It is not possible to attract vacationers and tourists by protecting one-half of the lake if the water resources and other natural features of the other half are allowed to deteriorate.

2. That the enforcement of these equal standards be encumbent upon the Department of the Interior.

3. That the Department of the Interior further pursue with means under its jurisdiction a course of action that will insure for future generations that there will be no further pollution or lowering of quality standards in Lake Champlain.

Finally, that the Department of the Interior do everything in its power to secure the removal of the sludge deposit from Lake Champlain.

Finally, as a final note, I would say I have a son in the Corps of Engineers in the Detroit office. And from his reports in the area and around Detroit. I would implore you, sir, do not let it happen here.

Thank you.

MR. STEIN: We were out in Detroit a few weeks ago, sir.

Does your county face across the lake that Republic operation?

MR. WILLIS: Yes.

MR. STEIN: I knew New England was literary, but I never knew I would come up here and find Addison and Steele.

Thank you.

(Laughter.)

May we call on Vermont for the next presentation?

MR. MILLER: I would like to present Mrs. N. C. Garland who has been very active with our State League of Women Voters, but who is at these proceedings acting as chairman of the Vermont Natural Resources Council. Mrs. Garland.

STATEMENT OF
MRS. N. C. GARLAND
VERMONT STATE BOARD
LEAGUE OF WOMEN VOTERS
BURLINGTON, VERMONT

MRS. GARLAND: Mr. Chairman, I am reluctant to contradict Mr. Miller, as always, but I am here making a statement for the Vermont League of Women Voters which is supported, of course, by the Vermont Natural Resources Council.

MR. STEIN: We know what the dominant agency is in the State.

Mrs. N. C. Garland

MR. MILLER: Thank you, Mr. Chairman.

MRS. GARLAND: The Vermont League of Women Voters appreciates the opportunity to participate in the conference proceedings. For well over a decade the members of the Vermont League of Women Voters have been concerned with water pollution and pollution abatement within our State. And the Leagues along the shores of Lake Champlain have been particularly interested in this study.

We have supported our State in their consideration and adoption of stringent qualification standards, and we have participated in the hearings establishing the classification for the lake. We urged a classification of B which would allow the use of the lake for water treatment facilities and also for swimming. And we were delighted that this was what came to pass.

The purity of the waters of Lake Champlain are of utmost importance to the health and well-being of the citizens of Vermont who live in the Champlain Basin. Many of our cities and towns, as has been pointed out, use the lake for water supply. And these demands are ever increasing.

The lake is also a major source of recreation for the citizens of the State of Vermont. We use it for boating and fishing and swimming. And it is a prime economic factor in the development of the entire region as a potential for major recreational area for the entire area of the Northeast.

The people of the State of Vermont fully realize the importance of Lake Champlain. They have demonstrated this time and time again by their willingness even in this era of the taxpayers' revolt to vote money for sewage treatment plants to bring about the desired B classification of our lake. In fact, in the last session of the Vermont General Assembly, we passed some outstanding environmental legislation, particularly in the field of water pollution abatement. And this was supported by the citizens of our State wholeheartedly.

I feel it is unfair to expect the people of the State of Vermont to bond for treatment facilities while the major source of pollution affecting the water quality of our lake lies buried beneath the waters of Ticonderoga Bay. Almost two years ago we attended the first session of this conference. And at that time, we had hopes that solutions would be forthcoming. And here we are now in 1970. We are a bit discouraged, Mr. Chairman.

These matters are so very complicated, we feel we must look, as our good Governor pointed out this morning, to the Federal Government for solutions of these matters. There is nothing the State of Vermont can really do about this particular problem. We urge you to move with all possible speed to bring about solutions for us.

Thank you.

MR. STEIN: Thank you, Mrs. Garland.

Any questions?

(No response.)

Thank you for a very excellent statement.

Mr.Miller.

MR. MILLER: Is Mr. John Williams still here?

MR. WILLIAMS: Yes, sir.

MR. MILLER: Mr. Williams, you wish to make a statement on behalf of Mount Independence Associates, which is opposite Ticonderoga, of equal historical importance? Would you make your statement from the podium and perhaps afterwards you would fill out one of these cards for our records.

Mr. John Williams.

STATEMENT OF
JOHN A. WILLIAMS, CO-CHAIRMAN
MOUNT INDEPENDENCE ASSOCIATES, INC.
MONTPELIER, VERMONT

MR. WILLIAMS: Mr. Chairman, ladies and gentlemen, it is a privilege to represent Mount Independence and particularly my co-chairman, Robert Maguire, who lives in that area for you this afternoon.

Mount Independence Associates, Inc., is a creature of the legislature a couple of years ago. So we are acting with the authority of the people of Vermont in developing this area, some 300 acres or so, immediately opposite Fort Ticonderoga as a historic park for the public.

We are, of course, very much concerned that the waters surrounding this park are pure. As it is now, when we go down there, we find dead fish on the shore and a very polluted atmosphere surrounding Mount Independence. So that it is actually unfit for opening. And I would like to point out that we want to open it to the public prior to the bicentennial 1976 at which time, of course, nationally and Statewide, there will be celebrations in honor of this great event.

You will recall that at Mount Independence, the troops retreating from Quebec after that disastrous winter up there held up for a short time the British and then moved back to Bennington and on to Saratoga where the rebels, so-called, made their stand and reversed the Revolutionary War. And, of course, it was at Mount Independence in 1776 when the guns at Mount Independence held up the British for roughly a year until they came back the following year in 1977 and passed through, supported, of course, by Benedict Arnold and his fleet.

But in essence, this is the tremendous significance of Mount Independence. And of all the historic sites in the State, it is by far the most significant and most important. It is particularly important to us to have pure water there and a pure atmosphere. This is what we are seeking. And Mount Independence Associates, Inc., which has, of course, in its membership, not only Vermonters, but also the officers, the directors and the staff of Fort Ticonderoga -- in other words, we are a joint Vermont-New York association working hand in glove to establish this post for opening within the next few years.

So when I thank you, I thank you on behalf of both the New York side and the Vermont side. Thank you very much.

MR. STEIN: Do you want this letter that you have prepared in the record?

MR. WILLIAMS: Yes, we would like very much to have the letter entered.

MR. STEIN: This one of your statements, "The deposits are the accumulation of years of waste from the International Paper Company's mill," --

MR. WILLIAMS: Yes.

MR. STEIN: -- that shows you how we have expanded globally. Mount Independence started with the Federal papers and now we have International Papers.

(The above-mentioned letter follows.)

Mount Independence Associates, Inc.
THE STATE HOUSE
MONTPELIER, VERMONT 05602

June 10, 1970

The Honorable Deane C. Davis
Governor of Vermont
Montpelier, Vermont

Dear Governor Davis:

Owing to the status of Mount Independence as one of the nation's most important Revolutionary sites, it is expected that it will be one of the major places of interest in observances now being planned for the commemoration of the bicentennial of the Revolution in 1975, on which occasion the area is scheduled to be opened to the public.

In this connection, we would like to call your attention to a nuisance of major proportions which exists at Mount Independence which if not eliminated can be expected to interfere seriously with the public's use and enjoyment of this pre-eminent historic site. Extensive sludge deposits in Lake Champlain surrounding Mount Independence are the source of a nauseating smell which permeates the entire area, making a visit to the place a distinctly unpleasant experience. The deposits are the accumulation of years of waste from the International Paper Company's mill at Ticonderoga, N.Y., carried into the lake by way of Ticonderoga Creek, the mouth of which is directly opposite Mount Independence. The foulness of the water makes an appalling spectacle and with the resulting indescribable odors the two conditions create a most uninviting background for Vermont's foremost historic site.

We hope and urge that the strongest measures will be taken by the State of Vermont to ensure the clean-up of this shameful condition in Lake Champlain which constitutes such an indefensible interference with the right of the people of Vermont to clean air and water.

Sincerely,

/s/ J. Robert Maguire
J. Robert Maguire

/s/ John A. Williams
John A. Williams

Co-Chairmen,
Mount Independence Associates

cc. Denning Miller, Chairman
Vermont Water Resources Board

MR. STEIN: Mr. Miller.

MR. MILLER: The last indication I have is from Gregory Brown who is a volunteer worker for the Lake Champlain Committee who lives in Burlington, Vermont, and would like to make a brief statement if he is still here.

Mr. Brown.

MR. BROWN: I am still here. I do not have a statement prepared at this time.

MR. MILLER: I see. Then this was a mistake. It was marked a statement, but we are very glad to have you here. And if you have nothing to give us, we will proceed.

Now, is there any other Vermonter who has made up a statement who wishes to contribute anything material to these proceedings?

(No response.)

If not, Mr. Stein, that concludes our presentation.

MR. STEIN: Thank you.

We will call on New York, Mr. Eastman.

MR. EASTMAN: The statement for the New York State Department of Health which is now the official water pollution control agency of New York State will be made by Mr. Donald Stevens who is the Director of the Bureau of Water Quality Management in the Division of Pure waters.

I might mention effective July 1, the water as well as the air pollution control function in the State of New York will become a part of the newly created Department of Environmental Conservation.

STATEMENT OF
DONALD B. STEVENS, DIRECTOR
BUREAU OF WATER QUALITY MANAGEMENT
DIVISION OF PURE WATERS
NEW YORK STATE DEPARTMENT OF HEALTH

MR. STEVENS: Mr. Chairman, conferees, ladies and gentlemen, this report summarizes the events which have occurred since the first session of the Lake Champlain enforcement conference in November 1968 within the New York State portion of the basin.

ENFORCEMENT

Dr. Ingraham as the Commissioner of Health has issued orders against 14 polluters requiring abatement of present waste disposal practices. All are proceeding on a satisfactory course of action with the exception of the J. J. Rogers Company of Ausable Porks, Clinton County. Although the company has made some efforts in reducing its waste flow as a result of in-plant changes, the company is in default of the schedule established in the order and additional legal action is being planned. The other dischargers have either submitted final plans or reports to remedy their pollution problems or are actually constructing facilities. The Village of Bloomingdale and the Westport Sewer Association have entered into contractual arrangements with the State Pure Waters Authority to construct the necessary treatment facilities. After July 1, 1970, this agency will be known as the Environmental Facilities Corporation. Appended to this report is a table which summarizes the identified sources of pollution.

The new International Paper mill at Ticonderoga estimated to cost in excess of $78 million is presently 80 percent complete with start-up scheduled, as far as we know, for January 1, 1971. The latest water pollution abatement facilities have been incorporated within the overall design and are estimated to cost in excess of $3.8 million.

The City of Plattsburgh has combined with three paper mills, Georgia Pacific, Diamond National and Imperial Paper to jointly treat their wastes. Bids were received by the city in May and construction is expected to start on the $9 million sewage treatment plant by August 1, 1970.

PROJECT STATUS

Final plans or engineering reports for the following projects have been submitted to the State Department of Health:

Whitehall - Final report under review.

Saranac Lake Village - Final report under review.

Lake Placid Village - Final plans approved. Plant under construction.

Great Meadows Correctional Institution - Final plans approved. Plant under construction.

Ticonderoga Village - Final report under review.

Westport Village - Final plans approved. Plant under construction.

Plattsburgh City - Final plans approved. As indicated before, the three paper companies up there will be connected with this system.

International Paper Company - Final plans approved. Plant under construction.

CONSTRUCTION GRANTS

Since the start of the Federal construction aid program a total of 20 projects have either been completed, are under construction or are being considered and which are or will be eligible for financial assistance. These projects include municipalities under Commissioner's orders and those whose facilities are being upgraded on a voluntary basis to provide additional treatment. The total estimated cost of the eligible portion of these municipal projects totals approximately $26 million; these applications are expected to receive about $16 million in grant aid. State moneys will total about $11 million compared to the Federal contribution of about

$5 million. And this is summarized in another table.

OPERATION AND MAINTENANCE GRANTS

Since 1965, a total of 15 municipalities have received about $161,000 under the operation and maintenance grant-aids program. During the period some applications were withdrawn because of the applicants' inability to comply with the eligibility requirements, and this is also tabulated.

WATER QUALITY

In November 1968, after a public hearing, the Water Resources Commission reclassified a section of Lake Champlain extending from Crown Point to South Bay from "C" to "B". This is, you must remember, with reference to New York standards and not the Vermont or the New England.

The upgrading establishes the use of the waters for bathing, fishing and other uses except as a source of water supply and generally eliminates inconsistencies between Vermont and New York classifications for these waters.

While New York State has always felt that the quality of its waters should be maintained at a level consistent with its policy rather than using the numerical figures as set forth in its classifications and standards as the desired water quality, it has reemphasized this position by the adoption of an antidegradation statement. In essence this states that waters of a higher quality than existing

D. B. Stevens

standards would not be lowered in quality unless it was found to be necessary because of social and economic reasons.

BOAT POLLUTION

Legislation passed in New York State prohibits discharges of inadequately treated sewage and galley wastes from boats plying New York's water. This requires the installation of holding tanks on the boats and pump-out facilities on shore. We are very pleased to see the buttons that are here as well as the sign that is on the front of the podium.

OIL POLLUTION

The New York State Legislature, in the 1970 session, passed legislation permitting the State Commissioner of Health to adopt administrative rules and regulations for the storage of liquids likely to pollute the waters of the State. While this was primarily directed at petroleum products, it is not limited to these materials. The rules and regulations are being developed.

In addition to this the State Department of Health is the vital link in the National Contingency Plan for oil pollution alerts as it relates to New York State.

COMPREHENSIVE STUDIES

In our report at the previous conference we gave a summary status of our comprehensive public sewerage studies and public water supply studies. Since that time we have accepted the sewerage study for entire Clinton County and for Warren County. In addition, there is under way one which covers Essex County and an application for a study of Washington County has been approved by the State Department of Health on May 22, 1970.

With reference to comprehensive public water supply studies, a contract for Clinton County has been completed as well as one for Warren County. The study for Essex County is under way, and a study for Franklin County is being currently negotiated.

WATER QUALITY SURVEILLANCE NETWORK

There has been no change in this program as outlined in our previous report.

MERCURY

Recently there has been considerable interest in the matter of mercury as a pollutant. New York State has undertaken an intensive survey of potential mercury users based on our knowledge of industrial use. This includes chemical plants, agricultural pesticide manufacturers, pulp and paper mills, chlor-alkali plants, explosives, battery and instrument manufacturers. Our data to date shows one current user in the basin and one that discontinued use about 1966. Further checks are under way to learn more about uses by one plant and also widen the search for possible users.

The State Health, Conservation and Agriculture and Markets Departments have undertaken a coordinated comprehensive survey of the concentration of mercury in fish. Unfortunately, we do not have the results of this at the moment. Five samples were collected from Lake Champlain to determine the concentration of mercury in the lake water. Three of these showed less than 0.5 parts per billion, and the other 2 were between 1 and 2 parts per billion.

SLUDGE REMOVAL

There has been considerable discussion over the years as to the effects of existing sludge beds in Lake Champlain as the result of industrial operations. There have been suggestions that these be removed for various reasons.

Fishing is an important aspect of the uses to which the lake has been put. Therefore, we have asked our Conservation Department to prepare a statement as to their views relative to the impact on fishlife of disturbing these deposits.

MR. STEIN: That should be "distributing" -- of distributing. You said "disturbing". I think that is key.

MR. STEVENS: In summary the State program to abate pollution in Lake Champlain Basin is proceeding satisfactorily and it will be given new impetus as of July 1, when the new Department of Environmental Conservation assumes the responsibility for all environmental problems.

MR. STEIN: You mean "distributing", don't you?

MR. STEVENS: Disturbing was the main intent.

MR. STEIN: I think the impact of it means disturbing.

Are there any comments or questions?

(The above statement in its entirety follows.)

New York State
Water Pollution Control
Lake Champlain
and its Tributaries

June 1970

Division of Pure Waters

New York State Department of Health

STATEMENT TO THE CONFEREES
LAKE CHAMPLAIN ENFORCEMENT CONFERENCE

BY

DONALD B. STEVENS, DIRECTOR
BUREAU OF WATER QUALITY MANAGEMENT
DIVISION OF PURE WATERS
NEW YORK STATE DEPARTMENT OF HEALTH

JUNE 25, 1970

This report summarizes the events which have occurred since the first session of the Lake Champlain Enforcement Conference in November 1968 within the New York State portion of the basin.

ENFORCEMENT

Dr. Ingraham as the Commissioner of Health has issued orders against 14 polluters requiring abatement of present waste disposal practices. All are proceeding on a satisfactory course of action with the exception of the J. J. Rogers Company of Ausable Forks, Clinton County. Although the company has made some efforts in reducing its waste flow as a result of in-plant changes, the company is in default of the schedule established in the order and additional legal action is being planned. The other dischargers have either submitted final plans or reports to remedy their pollution problems or are actually constructing facilities. The village of Bloomingdale and the Westport Sewer Association have entered into contractual arrangements with the State Pure Waters Authority to construct the necessary treatment facilities. After July 1, 1970, this agency will be known as the Environmental Facilities Corporation. The appended Table 1 summarizes the identified sources of pollution.

The new International Paper mill at Ticonderoga estimated to cost in excess of 78 million dollars, is presently 80% complete with start-up scheduled for January 1, 1971. The latest water pollution abatement facilities have been incorporated within the overall design and are estimated to cost in excess of 3.8 million dollars.

The City of Plattsburgh has combined with three paper mills, Georgia Pacific, Diamond National and Imperial Paper to jointly treat their wastes. Bids have been received by the city in May and construction is expected to start on the 9 million dollar Sewage Treatment Plant by August 1, 1970.

PROJECT STATUS

Final plans or Engineering Reports for the following projects have been submitted to the State Health Department.

Whitehall - Final Report under review.

Saranac Lake Village - Final Report under review.

Lake Placid Village - Final Plans approved. (plant under const.)

Great Meadows Correctional Institution - Final Plans approved. (plant under const.)

Ticonderoga Village - Final Report under review.

Westport Village - Final Plans approved. (plant under const.)

Plattsburgh City - Final Plans approved. (The Diamond National Corporation, The Imperial Paper Company and the Georgia Pacific Corporation will be connected to the municipal sewer system.)

International Paper Company - Final Plans approved. (plant under construction.)

CONSTRUCTION GRANTS

Since the start of the Federal Construction Aid program a total of 20 projects have either been completed, are under construction or are being considered and which are or will be eligible for financial assistance. These projects include municipalities under Commissioner's Orders and those whose facilities are being upgraded on a voluntary basis to provide additional treatment. The total estimated cost of the eligible portion of these municipal projects totals approximately 26 million dollars; these applications are expected to receive about 16 million dollars in grant-aid. State moneys will total about 11 million dollars compared to the Federal contribution of about 5 million dollars. The appended Table 2 summarizes the individuals applications, including the eligible project costs and grants.

OPERATION AND MAINTENANCE GRANTS

Since 1965, a total of 13 municipalities have received about $161,000 under the Operation and Maintenance grant-aids program. During the period some applications were withdrawn because of the applicants inability to comply with the eligibility requirements. The appended Table 3 summarizes the grants received by the municipalities.

WATER QUALITY

In November 1968, after a public hearing, the Water Resources Commission reclassified a section of Lake Champlain extending from Crown Point to South Bay from "C" to "B".

The upgrading establishes the use of the waters for bathing, fishing and other uses except as a source of water supply and generally eliminates inconsistencies between Vermont and New York classifications for these waters.

While New York State has always felt that the quality of its waters should be maintained at a level consistent with its policy rather than using the numerical figures as set forth in its classifications and standards as the desired water quality, it has reemphasized this position by the adoption of an antidegradation statement. In essence this states that waters of a higher quality than existing standards would not be lowered in quality unless it was found to be necessary because of social and economic reasons.

BOAT POLLUTION

Legislation passed in New York State prohibits discharges of inadequately treated sewage and galley wastes from boats plying New York's water. This requires the installation of holding tanks on the boats and pump-out facilities on shore. An appended list to this report gives the status of pump-out facilities in New York as of June 10, 1970.

OIL POLLUTION

The New York State Legislature, in the 1970 session, passed legislation permitting the State Commissioner of Health to adopt administrative rules and regulations for the storage of liquids likely to pollute the waters of the state. While this was primarily directed at petroleum products it is not limited to these materials; the rules and regulations are being developed.

In addition to this, the State Health Department is the vital link in the National Contingency Plan for oil pollution alerts as it relates to New York State.

COMPREHENSIVE STUDIES

In our report at the previous conference we gave a summary status of our comprehensive public sewerage studies and public water supply studies. Since that time we have accepted the sewerage study for entire Clinton County and # 188 for Warren County. In addition, there is underway #160 which covers Essex County and an application for a study of Washington County has been approved by the State Health Department on May 22, 1970.

With reference to comprehensive public water supply studies, contract #53 for Clinton County has been completed as well as #64 for Warren County; #50 for Essex County is underway and #70 for Franklin County is being negotiated.

WATER QULAITY SURVEILLANCE NETWORK

There has been no change in this program as outlined in our previous report.

MERCURY

Recently there has been considerable interest in the matter of mercury as a pollutant. New York State has undertaken an intensive survey of potential mercury users based on our knowledge of industrial use. This includes chemical plants, agricultural pesticide manufacturers, pulp and paper mills, chlor-alkali plants, explosives, battery and instrument manufacturers. Our data to date shows one current user in the basin and one that discontinued use about 1966. Further checks are underway to learn more about uses by the referred and to also widen the search for possible users.

The State Health, Conservation and Agriculture and Markets Departments have undertaken a coordinated comprehensive survey of the concentration of mercury in fish.

SLUDGE REMOVAL

There has been considerable discussion over the years as to the effects of existing sludge beds in Lake Champlain as the result of industrial operations. There have been suggestions that these be removed for various reasons.

Fishing is an important aspect of the uses to which the lake has been put. Therefore we have asked our Conservation Department to present a statement as to their views relative to the impact of fishlife of distrubing these deposits.

In summary the State program to abate pollution in Lake Champlain Basin is proceeding satisfactorily and it will be given new impetus as of July 1, when the new Department of Environmental Conservation assumes the responsibility for all environmental problems.

ENFORCEMENT PROGRAM
LAKE CHAMPLAIN DRAINAGE BASIN

Table Explanation

Location - municipal subdivision location of nonmunicipal entities. (T) - Town, (V) - Village, (C) - City

Ownership: Individual - multiple private discharges, no sanitary sewers, community not legally responsible. If the community fails to install a municipal system, individuals must abate pollution individually or collectively.

Pop. or flow - 1960 census population of community if known, residency and employment of institution or industrial waste flow of corporation.

Abatement Status -

A - Under Commissioner's Orders

B - Hearing noticed to establish Commissioner's Order

C - Hearing to be noticed

D - Under Department directive (voluntary compliance)

1 - Identified
2 - Initial conference held
3 - Schedule established
4 - Solution established via preliminary report approval (including special study)
5 - Final plans submitted and approved
6 - Under construction
7 - Completion of construction, installation of facilities or internal modifications
8 - Abatement partially achieved
9 - Abatement achieved

Ordered construction completion - completion date of needed construction, established by Commissioner's Order

Voluntary construction completion - completion date of needed construction, established by Department directive 4/1/72 (expiration of State grant program) indicates latest possible date; negotiations under way to establish finite schedule.

TABLE 1 - ENFORCEMENT PROGRAM
LAKE CHAMPLAIN DRAINAGE BASIN

June 1970

Waste Source	Location	County	Receiving Waters	Effluent: Raw or Primary	Effluent Type	Ownership: Corp., Inst., Mun. or Ind.	Pop. or Flow	Abatement Status	Ordered Constr. Complete	Vol. Constr. Complete
Rouses Point (V)		Clinton	Lake Champlain	Primary	Sanitary	Municipal	2160	D-3		4/1/72
Plattsburgh (C)		Clinton	Lake Champlain	Primary	Sanitary	Municipal	2072	A-5	7/1/70	
Diamond National Corporation	Plattsburgh (C)	Clinton	Lake Champlain	Raw	Pulp and Paper	Corporate	1 mgd	A-5	7/1/70	
Georgia-Pacific Corporation	Plattsburgh (C)	Clinton	Lake Champlain	Raw	Pulp and Paper	Corprate	6 Mgd	A-5	7/1/70	
Imperial Paper	Plattsburgh (C)	Clinton	Saranac Lake	Raw	Pulp and Paper	Corprate	1 mgd	A-5	7/1/70	
J.J.Rogers Co.	Ausable Forks (H)	Clinton	Ausable River	Raw	Pulp and Paper	Corporate	1 mgd	A-3	11/1/70	
Willsboro (H)	Willsboro (T)	Essex	Bouquet River	Raw	Sanitary	Individual	867	D-4		4/1/72
Saranac Lake (V)		Essex	Saranac River	Primary	Sanitary	Municipal	1.8 mgd	A-5	9/1/72	
Lake Placid (V)		Essex	Chubb R.	Primary	Sanitary	Municipal	.8 mgd	A-5	5/1/71	
Bloomingdale (V)		Essex	Twobridge Brook	Raw	Sanitary	Municipal	500	A-4	9/1/70	
International Paper Company	Ticonderoga (T)	Essex	Ticonderoga Creek	Raw	Pulp and Paper	Corporate	21.4 mgd	A-6	7/1/70*	

* Company presently constructing new production plant with secondary treatment facilities. Phase out of old plant expected by Mid 1971.

TABLE 1 - ENFORCEMENT PROGRAM
LAKE CHAMPLAIN DRAINAGE BASIN

June 1970

Waste Source	Location	County	Receiving Waters	Effluent: Raw or Primary	Effluent Type	Ownership: Corp.,Inst., Mun. or Ind.	Pop. or Flow	Abatement Status	Ordered Constr. Complete	Vol. Constr. Complete
Westport Sewer Association	Westport (V)	Essex	Lake Champlain	Raw	Sanitary	Corporate	723	A-6	12/1/70	
Port Henry (V)		Essex	Lake Champlain	Primary	Sanitary	Municipal	1767	D-3		4/1/72
Crown Point (H)	Crown Point	Essex	Lake Champlain	Raw	Sanitary	Individual	1500	D-4		4/1/72
Ticonderoga (V)		Essex	Ticonderoga Creek	Raw	Sanitary	Municipal	3568	A-4	9/1/70	
Whitehall (V)		Washington	Barge Canal	Raw	Sanitary	Municipal	4016	A-4	9/1/70	
Delaware & Hudson R.R.	Whitehall (V)	Washington	Barge Canal	Raw	Oil	Corporate	----	A-6	9/1/70	
Granville (V)		Washington	Metawee River	Raw and Primary	Sanitary	Municipal	2715	A-6	1/1/70	
Comstock State Prison	Ft. Ann (T)	Washington	Barge Canal	Primary	Sanitary	Institutional	1500	D-6		
Ft. Ann (V)		Washington	Barge Canal	Primary	Sanitary	Municipal	453	D-3		4/1/72

TABLE 2-LAKE CHAMPLAIN DRAINAGE BASIN
CONSTRUCTION GRANTS PROJECT

JUNE 1970

Project Number	Applicant	County	Eligible Project Cost*		Grant Amount*		Start of Construction
			Federal	State	Federal	State	
194	Lake George (V)	Warren	292,222	62,855	145,500	18,856	Completed
686	Lake George (V)	Warren	(44,800)	(44,800)	(13,440)	(13,440)	Fiscal Year 70-71
353	Keeseville (V)	Clinton	1,231,496	(1,231,496)	369,448	(369,448)	Under Construction
521	Plattsburgh (C)	Clinton	(9,425,600)	(9,425,600)	110,000	(5,545,360)	Fiscal Year 70-71
488	Bloomingdale (V)**	Essex	(266,666)	(266,666)	(80,000)	(80,000)	Fiscal Year 71-72
442+	Lake Placid (V)	Essex	2,273,200	(2,273,200)	750,156	(681,960)	Fiscal Year 70-71
180	Port Henry (V)	Essex	343,600	69,398	162,500	20,819	Completed
522	Westport (V)***	Essex	525,100	525,053	157,530	157,515	Under Construction
443+	Saranac Lake (V)	Franklin-Essex	1,081,300	(1,081,300)	356,830	(324,390)	Fiscal Year 70-71
284	Lake George (T)	Warren	602,265	590,300	198,747	177,090	Completed
466	Granville (V)	Washington	916,000	(916,000)	274,800	(274,800)	Under Construction
555	N.Y.S. Dept. of Correction-Great Meadows Correctional Institution	Washington	889,023	NONE	266,706	NONE	Under Construction

* Figures in parenthesis are estimated costs; other figures are costs agreed to by local, state and federal agencies

** Pure Waters Authority supervising project under a contract with village

*** Pure Waters Authority is actual applicant under a contract with village

+ Applicant eligible for additional 10% federal grant for complying with regional plan

TABLE 2-LAKE CHAMPLAIN DRAINAGE BASIN
CONSTRUCTION GRANTS PROJECT

JUNE 1970

Project Number	Applicant	County	Eligible Project Cost*		Grant Amount*		Start of Construction
			Federal	State	Federal	State	
698	Ticonderoga (V)	Essex	(2,443,600)	(2,443,600)	(733,080)	(733,080)	Fiscal Year 71-72
	Moriah (T)** Sewer Districts #1 & #2	Essex	(150,000)	(150,000)	(45,000)	(45,000)	Fiscal Year 71-72
699	Whitehall (V)	Washington	(3,139,000)	(3,139,000)	(31,390)	(1,852,080)	Fiscal Year 71.72
630	Plattsburgh (T) Cumberland Corners Sewer District	Clinton	(293,400)	(293,400)	(88,020)	(88,020)	Fiscal Year 70-71
697	Plattsburgh (T) Route 3 Sewer District	Clinton	(305,700)	(305,700)	(91,710)	(91,710)	Fiscal Year 70-71
	Plattsburgh (T) Champlain Park Sewer District	Clinton	(256,000)	(256,000)	(76,800)	(76,800)	Fiscal Year 71-72
	Dannemora (V) and State Prison	Clinton	(1,600,000)	(1,600,000)	(480,000)	(480,000)	Fiscal Year 71-72
	Peru (T) Sewer District #1	Clinton	(800,000)	(800,000)	(240,000)	(240,000)	Fiscal Year 71-72

TABLE 3-OPERATION AND MAINTENANCE GRANTS OF SEWAGE TREATMENT WORKS IN LAKE CHAMPLAIN DRAINAGE BASINS

COUNTY	MUNICIPALITY	YEARS APPROVED	TOTAL GRANT TO DATE	LATEST O & M GRANT AND YEAR	
Essex	Moriah (T) S.D.#1	66 - 68	$2,140	$781	(68)
Essex	Moriah (T) S.D.#2	66 - 68	3,440	773	(68)
Essex	Lake Placid (V)	65,67-69	9,141	2,956	(69)
Essex	Port Henry (V)	66 - 69	7,159	2,198	(69)
Franklin	Saranac Lake (V)	65 - 69	11,707	3,995	(69)
Clinton	Plattsburgh (C)	65 - 68	56,594	12,335	(68)
Clinton	Rouses Point (V)	65 - 68	10,751	3,317	(68)
Clinton	Dannemora (V)	65 - 68	5,114	1.550	(68)
Clinton	Peru (T) S.D.#1	65	1,887	1,887	(65)
Clinton	Plattsburgh (T) Champlain Park S.D.	65	1,582	1,582	(65)
Clinton	Champlain (V)	65 - 66	1,611	1967 application was withdrawn because it had some deficiencies	
Warren	Bolton (T) S.D.	65 - 68	11,299	3,016	(68)
Warren	Lake George (V)	65-66, 68-69	38,745	14,420	(69)

LISTING OF EXISTING PUMP-OUT FACILITIES AS OF NOVEMBER 1969

Cayuga County
1 Castelli Marina
X Union Springs
2 Troy's Marina
X Union Springs
Fulton County
3 Botilin Boat Works
X Mayfield
Greene County
4 Hop-O-Nose
X Catskill
Jefferson County
5 Calumet Island Marina
X Clayton
X 6 Anchor Marine
Cape Vincent
X 7 Rogers Texaco Marina
Alexandria Bay
X 8 Bonnie Castle Yacht Basin
Alexandria Bay
X 9 Washington Island Marina
Clayton
X 10 Hutchinson Boat Works
Alexandria Bay
X 11 Van's Motor Marine
Alexandria Bay
X 12 Mercier Shipyard
Clayton
Monroe County
X 13 Owens-Rochester
Rochester
Schuyler County
X 14 Jerry's Boatarama
Watkins Glen
Warren County
X 15 Dunham's Bay Boat Co
Lake George
16 Topaz Marina
Warner's Bay
X Lake George
X 17 Scott M. Henderson
Cleverdale

LIST OF MARINAS INDICATING THEY WILL INSTALL FACILITIES BY MARCH 1970

Albany
1 Blain's Bay Marina
Cohoes
2 Gerry Finke's Marine
Coeymans
Cayuga
3 Hibiscus Harbor
X Union Springs
Chautauqua
4 Bart's Cove
X Dunkirk
Dutchess
5 White's Marina
New Hamburg
Erie
6 Jafco Marina
Buffalo
Essex
7 Westport Marine Base
Westport
Franklin
8 Veeler & Dumas Marina
Fort Covington
Fulton
X 9 Sacandaga Marine
Mayfield
Greene
10 [illegible]'s Marina
New Baltimore

Herkimer
11 Ilion Marina
Ilion
Jefferson
12 Cape Vincent Boat Works
Cape Vincent
X 13 Crescent Marina
Chaumont
14 Phelps & Connell
Henderson Harbor
X 15 Thousand Island Marine
Thousand Island
XXXXXXXXXXXXXXX
XXXXX
Madison
17 Fisher Bay Marina
Bridgeport
Monroe
X 18 Capt.Jeff's Marina
Rochester
X 19 Riverview Yacht Basin
Rochester
20 Rochester Yacht Club
Rochester
Nassau
X 21 Glen Cove Yacht Serv
Glen Cove
22 Davison's Boat Yard
East Rockaway
X 23 Aqua Marina Associations
Freeport
24 Neptune Boat Basin
Seaford
25 Oyster Bay Yacht Service
Oyster Ba
26 Lakes Boatyard
Freeport
XXXXXXXXXXXX
XXXXXXX
XXXXXXXXXXXXXXXXX
XXXXXXXX
29 Seaford-Mar Marina
Seaford
New York City
30 Higgs Marine Service
Bronx
31 Locust Point Marina
Bronx
XXXXXXXXXXX
XXXXXX
33 Marine Basin Marina
Brooklyn
XXXXXXXXXXXXX
XXXXXXXXXX
X 35 Consolidated Yachts
City Island
36 Marine Park Boats
Brooklyn
37 Thwaites Marina
City Island
38 Dimeglio's Boatyard
Brooklyn
39 Mayers Marina
College Point
Niagara
40 Wardell Boat Yard
No Tonawanda
41 Star-Isle Marina
No Tonawanda
Oneida
42 Marcy Marina
X Marcy
X 43 Skinner Harbour
Sylvan Beach
X 44 Sylvan Beach Boat Yard
Verona Beach

Onondaga
45 Ace Boat Yard
X Brewerton
X 46 Aero Marina Conway
Brewerton
47 Baldwinsville Boatyard
Baldwinsville
X 48 Cooper's Marina
Baldwinsville
49 Onondaga Lake Marina
DPW-Div.of Parks
Liverpool
50 Pirate Cove Marina
Clay
51 Oswego Marina
Syracuse
Ontario
52 Seneca Marine Mart
Geneva
X 53 Shepard Marine
Canandaigua
Orange
54 Hamaford's Marine Base
Newburgh
Oswego
55 Tanner's Marina
Constantia
Rockland
56 Cornetta's Marina
Piermont
57 High Tor Marina
New City
Saratoga
58 Schuylerville Yacht
Schuylerville
St.Lawrence
XXXXXXXXXXX
XXXXXXXX
Seneca
60 Wright's Boat Yard
Waterloo
Suffolk
X 61 Lands Rd Marina
Sayville
62 Anchor Marina Ltd
Montauk
X 63 Babylon Yacht Marina
Babylon
64 Halsey's Marina
E Hampton
65 Three Harbors Marine
Huntington
66 Viking Fishing Fleet
Montauk Harbor
67 Triangle Boat Yard
Greenport
68 Coecles Harbor Marina
Shelter Island Boat Yard
XXXXXXXXXXXXXXXXXX
XXXXXXX
70 [illegible] Marine
Hampton Bays
71 Maidstone Boat Yard
E Hampton
72 So Jamesport Boat Marina
South Jamesport
X 73 Bay Shore Marine Basin
Bay Shore
74 Richard Tooker Boat Yard
Brookhaven
75 Southold Fishing Station
Southold
XXXXXXXXXXXXXX
XXXXXXX
X 77 1 Mi Harbor Boat Yard
East Hampton
XXXXXXXXXX
XXXXXXX

Suffolk (Cont.)
X 79 Pebler's Marina
Lindenhurst
80 Gudzik's Marine
Port Jefferson
Tompkins
81 Inlet Park Marina
X Ithaca
X 82 Finger Lakes Marine Service
Myers
X 83 Johnson Boat Yard & Marina
Ithaca
Ulster
84 Roundout Marine
Connelly
Warren
85 Lake George Boat Co
Lake George
Westchester
86 Bureau Marine Docks & Harbors
New Rochelle
X 87 Nichols Yacht Yards,Inc
Mamaroneck
88 Westerly Marina Inc
Ossining
XXXXXXXXXX
XXXXXXXX
New Rochelle
Yates
XXXXXXXXXXXXXXXX
XXXXXXXXX
XXXXXXXXXXXXXXX
XXXXXXX

NEW MUNICIPAL MARINAS 50% STATE FINANCED

Erie Basin Marina
Buffalo (Erie)

Island Park's Marina
Hog Island Channel
Island Park (Nassau)

Port Chester Marina
Port Chester
(Westchester)

Sackett's Harbor
Sackett Harbor
(Jefferson)

North Tonawanda
Niagara River
(Erie)

Lindenhurst Marina
Lindenhurst(Suffolk)

BOAT LAUNCHING SITES

Mossy Point (Essex County)
South Bay (Washington County)
Willsboro (Essex County)

PROPOSED PUMP-OUT FACILITIES AT STATE PARKS
(TO BE IN OPERATION PRIOR TO MARCH 1, 1970)

1 Cayuga Lake State Pk Marina,
X 3 Miles East of Seneca Falls
X 2 Fairhaven State Park BLS
2 Miles North of Fair Haven
3 Keuka Lake State Park BLS
6 Miles Southwest of Penn Yan
X 4 Seneca Lake State Park Marina
1 Mile East of Geneva
X 5 Taughannock Falls State Park
Marina
8 Miles North of Ithaca
6 Sampson State Park Marina
12 Miles Southeast of Geneva
X 7 Beaver Island State Park Mari
9 Miles North of Buffalo
X 8 Big Six Mile Creek Marina
4 Miles South of Niagara Fall
X 9 East River Marina
Grand Island,South of Niagara Fal
10 Golden Hill State Park
Lake Ontario,12 Miles East
X of Olcott
11 Cedar Point State Park
6 Miles West of Clayton
12 Kring Point State Park
6 Miles Northeast of
Alexandria Bay
13 Robert Moses State Park
Massena
14 Westcott Beach State Park
4 Miles So of Sacket's Harbor
15 Grass Point State Park
1 Mile E of Fisher's Landing
16 Jacques Cartier State Park
2 Miles So of Morristown
17 Long Point State Park
14 Miles Southwest of Three
Mile Bay
X 18 Norrie Point State Park Marina
North of Poughkeepsie
19 Captree State Park
47 Miles East of New York City
20 Jones Beach State Park
33 Miles from New York City
X 21 Braddock Bay State Park
Ten Miles West of Rochester
22 Cole's Creek
2 Miles Northeast of Waddingt
23 Wellesley Island State Park
2 Miles No of Thousand Island
Bridge
24 Keewaydin State Park
1 Mile West of Alexandria Bay
X 25 Robert Moses State Park
49 Miles East of New York

Status 6/10/70
"X" means these pump out station
are in operation.

Ticondergoa Village because we heard testimony this morning to the effect that the bacteria are violating Vermont water quality standards.

MR. STEVENS: Yes.

MR. PAHREN: O.K., going down in the Plattsburgh area, final plans approved for the city, and you indicate that the paper companies will connect to municipal sewer. The standards approved by the Secretary of the Interior indicate that they are supposed to be in operation by next week, July 1, 1970. Can you expedite this? We all know that Plattsburgh is a very polluted area itself.

MR. STEVENS: I would say that the explanation there is the same as it is in other places there; that we had orders against these places, and then we got this new law passed which required that the plants before approval would have to be in conformity with a comprehensive plan. And there have been delays, as I will say, between what we had in the order and our ability to get the comprehensive plan done.

MR. EASTMAN: Mr. Chairman.

MR. STEIN: Yes, go ahead.

MR. EASTMAN: I think it is worthy of noting, however, that this is an excellent example of the implementation of a comprehensive sewerage plant involving the entire area of Plattsburgh as well as these three major industrial plants. And we all recognize the values -- in fact, I understand the Federal Water Quality Administration on frequent occasions has emphasized the desirability -- of regional type metropolitan waste treatment systems. And I think this is a dramatic example of one of these which is now getting under construction.

But I think we can acknowledge that the plant wouldn't be completed by the end of next week.

MR. PAHREN: I am sorry to hear that, Mr. Eastman.

On the construction grants, you indicate State moneys will total about $11 million. Is this including reimbursable moneys or not?

MR. STEVENS: Yes.

MR. PAHREN: It includes reimbursable moneys?

MR. STEVENS: This is the actual money that New York State is putting up.

MR. STEIN: No, no. The question here is you are going to put up $11 million, and you say Federal contribution will be about $5 million?

MR. STEVENS: Right.

MR. STEIN: And of the $11 million, are you going to ask the Federal Government for any money for reimbursement?

MR. STEVENS: Yes.

MR. STEIN: Out of the $11 million?

MR. STEVENS: Yes.

MR. STEIN: In other words, you may be getting more than the $5 million if you are successful. This is your first go-around.

MR. STEVENS: This is what we are putting up now.

MR. STEIN: But do you intend to go in for reimbursement, raise the ante of the Federal Government?

MR. STEVENS: If the Fed will appropriate the money.

MR. EASTMAN: Mr. Chairman, in connection with that comment, we now have prefinanced over $440 million worth of the Federal share of projects in New York State. And I would emphasize that we have on repeated occasions urged the Federal Government to put the money where its rhetoric is in connection with these grants.

MR. STEIN: Well, let me say when you talk about Federal share, Federal share doesn't mean anything until it is appropriated. As far as I am concerned, Federal share is a rhetoric phrase of New York State. And since you put up all that money, I know the people in Vermont are appreciative of the clean waters you have been sending over to them.

MR. EASTMAN: We confirm that the Federal share is a rhetoric phrase, but it is not just a rhetoric phrase of New York State. I think it is a rhetoric phrase of the

Federal Government. And we hear it frequently. And I assume that we will continue to hear it frequently.

And more recently, I think at the Governors' conference, the President of the United States pledged himself to see at least up to the extent of his ability that all of these funds would be reimbursed to the States who in their foresightedness and their willingness to put up the dollars have prefinanced the Federal share.

MR. STEIN: I am sure, again, as Mr. Eastman as well as Vermont and as well as the well educated and intelligent audience we have are all familiar with the Constitution and the revenue powers of our establishment and everyone knows that rests with the Congress. And when we embarked on the program, the Executive of New York State did, and everyone else did, we recognized that we were operating within our constitutional form of government. And unless the Congress appropriated this money, the money is not available. There is no promise, there is nothing except a hunting license as far as I am concerned until the Congress appropriates the funds.

And this has been that way ever since the States ratified the Constitution.

MR. PAHREN: I would like to move on to page 4, Mr. Stevens, on your paragraph on mercury.

You indicate that there is one current user of mercury in the basin. Is anything being done to check if there is anything getting into the lake from this source and if steps are under way to eliminate any possible mercury from this current user?

MR. STEVENS: Yes. As far as elimination is concerned, they expect to shut down for a 3-week overhaul starting tomorrow night. And they expect when they come back into operation in 3 weeks that they will have changed the material that they are using to a non-mercury compound.

MR. PAHREN: O.K.

For the record, can you tell me what that source is?

MR. EASTMAN: We can give you the name of that discharger if that is necessary.

MR. PAINE: I think we are entitled to know.

MR. STEIN: Just a moment. We are not taking questions from the floor.

Do you want to ask the question or not? Do you want the name or do you want to mention the name yourself?

MR. PAHREN: Well, we brought out this morning that there were sources in the past that discharged mercury. And they have shut down any discharge. And you indicated that this source is shutting down its source of mercury tomorrow.

MR. STEVENS: Yes.

MR. PAHREN: Which means it is being eliminated. I would like to know.

MR. STEIN: Do you care to answer that?

MR. EASTMAN: We don't object to answering it if it is necessary for the record.

MR. STEIN: This is up to you if you want to answer it or not.

MR. EASTMAN: The company has been very cooperative. We directed them to come in with a schedule for complete elimination of mercury from its discharge. And this is the response that was given.

MR. STEIN: By the way, let me tell you the way I feel about it is as far as I can see in water supply or everywhere else, if mercury is a problem, we were remiss in checking. As far as I know, no one has been checking mercury for 20, 25 years. And I don't know of any plant or any discharger morally culpable for the discharge of mercury, really, because no one has bothered to call this to their attention. And this is a personal feeling.

Now, you can answer the question or not as to the source if you wish.

MR. EASTMAN: I think we can go ahead and answer it because, obviously, those around the room think we are trying to cover something up. But I think it is to the merit of the company that when they were directed to eliminate the discharge that they are immediately taking steps to do so.

MR. STEVENS: It is the Imperial Paper Company, Plattsburgh.

MR. STEIN: Any further questions or comments?

MR. PAHREN: Yes.

You indicated several -- I believe 5 -- samples regarding the water quality of Lake Champlain with respect to mercury content. You indicated very low values. Is there any question in your mind regarding the safety of the waters of Lake Champlain for drinking purposes?

MR. STEVENS: We have no reason to state that waters are not safe for drinking on the basis of the mercury that is present.

MR. PAHREN: So based on the technical knowledge available to officials, the levels that you have found are far below any levels that are considered unsafe, is that correct?

MR. STEVENS: That is correct.

You must remember that there are no official standards for mercury in the United States. Therefore, we have to depend on what values have been selected by foreign countries. And these are below the levels which foreign countries have felt were acceptable?

MR. STEIN: I would like to correct that. And I would like to just have a colloquy with you on this.

We do have one official requirement on mercury. And that is Food and Drug standard.

What is it? Five parts per billion?

MR. PAHREN: .5 parts per million in food.

MR. STEIN: This includes fish, and this includes meat. And presumably in the foodstuff, food material can't be shipped in interstate commerce for consumption by humans if it has .5 parts per million of mercury in it. This is a Food and Drug and Federal standard and is applicable and, as a matter of fact, it has been made effective in dealing with fish products coming out of Lake Michigan very recently. So we do have this.

I think Mr. Stevens is entirely right that we do not have a standard on mercury in water. And as a matter of fact, I think when we look at the statement, a good many of us came out of the public health services field and Federal or State operation. And I think I have to report to you that I have worked in drinking water standards as well as this for years. And I know a lot of the other people have. We have no mercury requirement in Federal drinking water standards. And the standard possibly that Mr. Stevens is alluding to -- and this is ironic enough -- is a Russian standard for drinking water.

Now, the problem that we have with mercury is putting small amounts of this in water. We know this gets concentrated by fish. We also have a pretty firm conviction that the mercury doesn't hurt the fish one bit. But when they keep concentrating it and if it is concentrated enough and humans eat the fish, this may create very serious consequences.

And as I pointed out, the Food and Drug Administration has standards on fish life that can't contain mercury. Again, I think maybe this is fortunate or unfortunate, but if you take the shellfish, something like an oyster or a clam which takes in tremendous amounts of water and concentrates it, maybe you can have large concentrations of mercury in a bivalve in a short period of time.

So far, we have not found mercury very much in these areas. However, if we find mercury in something like a lake such as Lake Erie or Lake Champlain or Lake Michigan, the fish there are, compared to the other fish, relatively slow growing and relatively slow concentrators. So the probability is unless you find an older fish, you are not going to find big concentrations of mercury.

And so we have to deal with several problems. One, the mercury in the water of the available mercury and the concentrations, the ability of the fish life to concentrate that mercury in how long they have been exposed to it.

This is not a very easy problem, but I think we are all pretty much agreed that we do want to reduce the mercury as much as possible.

Now, for whatever source they have named here, and we have had loads of sources in the country and the Canadians have had some sources, I would like to reemphasize what I said before. Mercury has come to the fore in the last few months. No one has called the attention of these industries or other sources to mercury discharges to the best of my knowledge. And I have been working in this field ever since I got back from World War II as a lot of these other people have. And I dare say unless I hear something from the others that as far as I can see, and I have worked with these fellows a full professional career, until the last few months, we never called the mercury discharge to anyone's attention. So if it is anyone's fault -- and I don't want to accuse the States on this -- I think it is the governmental and regulatory agencies' problem that we have not called this to anyone's attention. I would not like to hold an industry morally responsible for something that we left drift for 30 years and we are just calling their attention to it in a week.

By the way, I would like to make this clear: We have gotten a tremendous response, as you evidently have here, to a mercury reduction problem. About a month or six weeks ago, we started out in Lake Erie with mercury. As nearly as we could figure out, there were about 280 pounds a day in the Lake Erie drainage basin. Working with the States, with Canada, with the industry, I think this mercury is reduced to less than 10 pounds. And I hope within a week or two it will be less than 6 pounds and may be much less than 10 pounds now. But until we check this out exactly, I don't want to give you a more optimistic figure.

This is a pretty good reduction. I think we are experiencing the same thing in Lake Champlain. Once the State has identified a source of mercury, presumably the industry has voluntarily agreed to stop operations on that and cut it out.

We also have found that International Paper is not using mercury anymore.

So again I want to give you the experience--and I didn't say this alone here because a lot of other people at this table can duplicate the length of professional experience that I have had in this field--but in a quarter of a century, I don't think I have ever run into a reduction response that we have had in mercury from the various industries we have contacted in this area. And I think rather than condemnation, it shows what we can do when we really think it is important and want to do it.

Are there any others?

MR. EASTMAN: Mr. Chairman, I would like to add that to the best of our ability, we have been surveying the entire State of New York for sources of mercury. And insofar as Lake Champlain is concerned, as was mentioned by Mr. Stevens, we only find one current discharger. And the information from our own sampling of this discharge, as well as from the company which was very cooperative in revealing information to us, indicates that the discharge was less than .2 of a pound per day. And again this will be completely eliminated as of tomorrow and will not be resumed when the company resumes operations in 3 weeks.

We have been assured by the company that there will be no resumption because they are going to change from mercury compound to another compound for slimicide use in their operation.

MR. STEIN: Again, let me make one comment on this and not in the record referring to a name because we had this in public earlier this week. We were in New York City. And in the neighboring State to New York, we found a plant which we believe was putting out 28 pounds of mercury a day. And they have a much tougher problem.

As a matter of fact, I spent a good portion of my lunchtime working on that. We have knocked them down, I think, next week by a 10-pound margin which still leaves us 18 pounds which I think when you contrast that to what you are dealing with in Lake Champlain, you can see the difference. And we are working valiantly to reduce that.

So I think the mercury discharge problem is cropping up all over. I would say -- and let me indicate this to you unequivocally -- I think in finding the mercury problem and a significant mercury source in Lake Champlain, New York has taken as rapid and effective action to abate that source as any State or Federal regulatory agency I have seen in the country since we started this campaign in about the last two months.

Are there any other comments or questions?

MR. PAHREN: I have another comment just to complete the picture.

Mr. Stevens indicated the situation on the New York side. I would like to ask the Vermont people, first of all, are there any known mercury sources on the Vermont side?

MR. ALBERT: None that we know of.

MR. PAHREN: Secondly, have you taken water samples to check on the safety of the drinking water on the Vermont side? And what is your judgment on the safety?

MR. ALBERT: When we first heard of this mercury in the lake, we gathered about 36 samples randomly, beginning at the Canadian line down to about Whitehall. These samples are flown to your own Federal laboratory in Edison, New Jersey. And the report has come back to us that there is no trace of mercury.

Now, it is my understanding that the equipment is accurate to somewhere between 1.5 to 2 parts per billion. And no trace was found in that range.

MR. PAHREN: Therefore, the water is safe, in your judgment?

MR. ALBERT: I would presume on the basis of that information, yes.

MR. STEIN: Mr. Peloquin.

MR. PELOQUIN: I have two questions, Mr. Chairman.

Mr. Stevens, in connection with the comprehensive survey New York is doing, is this still on or was this just the initial analysis that is being performed now on the fish life for mercury determination? And are you going to do more than what is being analyzed now?

MR. STEVENS: As I indicated there, this was a cooperative undertaking by the Department of Health, the Department of Conservation and the Department of Agriculture and Markets to collect fish and exchange them. Unfortunately, they had a tremendous thunderstorm in the area of the Conservation Department laboratory, and this has interfered with the prompt distribution of the samples.

Now, we are hopeful that the fish are still available for analysis. And further action will have to depend entirely upon the results that we obtain from these.

MR. PELOQUIN: It is indeterminant at the present time whether there will be additional sampling and additional analysis.

MR. STEVENS: This would be dependent entirely upon the results that they find.

MR. PELOQUIN: The other question I have, Mr. Stevens, is you indicate that the city of Plattsburgh is expected to start conversion on its plant by August 1st. And in looking through the appended material, I see only the awarded construction completion date for the facility. Do you have a new completion date scheduled for the Plattsburgh facility?

MR. STEVENS: I believe there is one. I will have to check it out. I don't have it with me at the moment. But this, again, as I say, gets tied into these regional plants.

MR. PELOQUIN: Thank you.

MR. STEIN: Thank you.

Mr. Stevens, I have one. And I think this is an important issue.

On the first page of your statement, you say the new International Paper mill at Ticonderoga estimated to cost in excess of $78 million is presently 80 percent complete with start-up scheduled for January 1, 1971.

Now, if this is the case and the pulping operations are going to start up then with completed treatment, I think we have one situation. However, if as Mr. Masterman indicated this might not happen until the end of the year, I think we have another situation. I think it would help us all if we got these dates in because let's assume even if they keep some of the paper operations in the old plant, if the pulping operations in fact are going to start up by January 1, 1971, in the new plant, by and large, the major source of wastes from the Ticonderoga IP mill will be eliminated. And I think these dates become increasingly important because of the disparity.

We are really dealing with practically a year. If there can be any light shed on this, I think it would help the conferees in their executive session.

I don't know if we can have an answer to that right now, but maybe before we go in, you can confer with the mill.

Now, you also state -- I want to refer to page 3, the second paragraph -- while New York State has always felt that the quality of its water should be maintained at a level consistent with its policy rather than using the numerical figures as set forth in its classifications and standards as the desired water quality, it has reemphasized this position by the adoption of an anti-degradation statement. In essence, this states that waters of a higher quality than existing standards would not be lowered in quality unless it was found to be necessary because of social and economic reasons.

Now, I understand that the permit was issued to International Paper before this adoption. And this does not necessarily apply to the IP discharge.

MR. STEVENS: To a certain extent, that is true. The anti-degradation statement was adopted specifically by the State of New York approximately 2 months ago.

MR. STEIN: That's right, and the permit was issued considerably before that.

MR. STEVENS: That's right.

MR. STEIN: Are there any further comments or questions?

MR. PAHREN: One final point.

Mr. Stevens, to your knowledge, do you know if the waste treatment facilities for the new IPC plant will be constructed and ready for operation the very first day that the pulping begins at that new plant?

MR. STEVENS: To the best of my knowledge, yes.

MR. PAHREN: Can you obtain from IPC a definitive answer? Because it is a very important point.

Can we get this from the IPC representatives here?

MR. CARROLL: It is our understanding that the wastewater facilities will be operative when the pulping facilities begin to operate.

MR. STEIN: Will this be January 1, 1971?

MR. CARROLL: It will be expected to be prior to January 1, 1971.

MR. STEIN: Thank you.

Any other questions?

MR. HANSEN: I guess I do, Mr. Chairman.

In the reclassification of the New York waters below Crown Point from "C" to "B" which are referred to, what was the period of time for the water to reach B classification envisioned by the classification authority?

MR. STEVENS: The classification in this case refers to the degree of treatment which is required for the discharges to go into that water. In other words, what we are talking about is with the change in the classification, we would have to make certain changes insofar as the degree of treatment was concerned.

MR. HANSEN: Was there an anticipated time period by which those new treatment devices would be completed and in operation?

MR. STEVENS: This would be a case of working with existing dischargers and working out a time schedule for that necessary remedial work as well as applying immediately to any new dischargers.

MR. HANSEN: Was this in effect done in the classification order itself or the reclassification order?

MR. STEVENS: No, this would have to be done individually with the dischargers.

MR. HANSEN: So that no time schedules were set up in the reclassification order?

MR. STEVENS: No.

MR. HANSEN: Does this reclassification order take cognizance of the fact that the sludge in the lake at the present time is in itself a separate pollutant?

MR. STEVENS: No.

MR. HANSEN: Then, if the sludge remains in the lake and nothing is done about it, the B classification -- and I am asking your opinion in this respect -- would never be achieved.

MR. STEVENS: This, again, I think is a time question. It would be. The question is when.

MR. HANSEN: I would be interested if you would elaborate a bit more on that. In other words, you think if the sludge remains in the lake and no action is taken toward it that the waters themselves in some way will reach a B quality?

MR. STEVENS: That's right.

MR. STEIN: I don't want to necessarily interrupt, but I think we have Mr. Bromberg's statement. He said it would take years. When you use the word "never," it is a long time. And, you know, you put any organic material out, eventually it is going to stabilize and work out.

I think the pertinent question -- because this is a repetition of what Mr. Bromberg indicated -- is that he said it would take years before the B classification would be. I don't know. Maybe we would want to ask Mr. Stevens' opinion whether he has any more definitive judgment.

MR. HANSEN: I thought I might come to that. I have several other questions here.

MR. STEIN: All right.

MR. HANSEN: You have indicated that there was nothing in the reclassification order regarding the sludge itself as to any action to be taken. Has the State of New

York at any time taken any official action concerning this sludge and its pollutant effect on the lake?

MR. STEVENS: No.

MR. HANSEN: I would like to move, then, to the existing plant itself. And thinking back with a 10-year range from this time, did the State of New York at any time ever issue an order to the International Paper Company requiring treatment for the effluent discharged into Ticonderoga Creek?

MR. STEVENS: I think that was covered in Mr. Eastman's statement that the order was for them to cease and desist this pollution.

MR. HANSEN: This would be of a more recent vintage. This would have to do with the construction of the new plant. I am going back for about a 10-year period. Was there anything ever specifically ordered for treatment at this existing plant?

MR. STEVENS: That is not the way we operate. In other words, we do not order something to be put in. We order them to cease and desist. And we expect them to then come to us with their plan for how they propose to do it.

MR. HANSEN: Well, was such an order ever issued other than the one which we have heard about relative to, I believe, January 1 of 1971?

MR. STEVENS: There was just the one order that was issued.

MR. HANSEN: Can you give us the date of that order?

MR. STEVENS: Offhand, I can't unless it is in the tabulation here.

MR. HANSEN: Would it be before or after the initial phase of this conference in November of 1968?

MR. STEVENS: It would be prior to that.

MR. HANSEN: Prior to that time.

Has any further action been taken by the State of New York of an official nature relative to the existing plant since the conference in November of 1968?

MR. STEVENS: Only insofar as it would be meetings with the people and personal pressure put on them to get things done.

MR. STEIN: Mr. Stevens, I am confused, and permit me if I may, we had something prior to that, when prior to our conference, we found the order issued was 7/1/70 for completion of the new plant.

Now, I am just trying to reconstruct this factually. It was after our conference that the 1971 date was set -- after the first conference. You had a date of 1970 before that, and they asked for a variance, as we pointed out in the conference summary. And it was after the conference, not prior to it, that the 1971 date was set.

MR. HANSEN: The extension was granted after it.

MR. STEIN: After, if I am not mistaken. But I think the record shows that. As you can tell from the conference summary, we noted that International Paper Company -- and I am reading from our conference summary -- "has requested a modification." This was at our conference involving the discharge. This request for modification is based on the termination of all waste discharge by July 1, 1970.

In other words, as I see the record, there was an indication that this would be completed in 1970 before we had our conference. When we went to the conference, we were apprised of the fact that IP had asked for an extension or a modification until 1971, and this was granted after the conference, not before it.

I am bringing this out, but if I am wrong on the chronology on that, I would like to be corrected. This is what our records show here.

MR. EASTMAN: I think that is correct.* But there was no new order. It is the same order.

MR. STEIN: With a modification, yes. That's right.

* See appended letter of 7/17/70 wherein Mr. Eastman corrects his statement.

MR. MILLER: But the order was modified.

MR. STEIN: After the conference, right.

MR. MILLER: There is no confusion about this, is there, Mr. Stevens?

MR. HANSEN: I guess I have maybe one or two more questions here.

As I see it from what has been presented and what you have said, Mr. Stevens, I gather that the State of New York does not have any intention of regulating or controlling the effluent which is presently being discharged at the existing facility.

MR. STEVENS: We have been working with the company to clean up the situation, and the proposal which we accepted was the abandonment of the plant and the erection of a new one.

MR. HANSEN: But no controls were recommended of any nature to the existing effluent.

MR. STEVENS: That is right.

MR. HANSEN: Does the State of New York have an official position relative to the various recommendations for handling the sludge problem?

MR. STEVENS: At the moment, we would like to have the statement from our Conservation Department as to what they feel the effects on the lake would be by acting on the sludge.

MR. HANSEN: You were a member of the Technical Committee?

MR. STEVENS: I was.

MR. HANSEN: Did you have any particular feelings of a personal nature as to the various recommendations of the Corps of Engineers?

MR. STEVENS: It is noted that the recommendation said the majority. It was not unanimous.

MR. HANSEN: I was trying to get at really were you one of the minority or majority?

MR. STEVENS: I was.

MR. HANSEN: You were one of the minority?

MR. STEVENS: Right.

MR. HANSEN: Would you care to express your feelings as to why you were a member of the minority?

MR. STEVENS: The information which we had from our Conservation Department was that the effects on the lake of moving this material would be far less than leaving them alone.

MR. HANSEN: Is this information in documentary form so we might see it?

MR. STEVENS. This is why we asked our Conservation Department to come here and re-establish it.

MR. HANSEN: They will present a statement?

MR. STEVENS: Yes.

MR. HANSEN: I see.

If further study time is necessary, the position of the State of New York is still that there is no need even during this delayed time period to regulate and control the effluent presently being discharged by the present facility?

MR. EASTMAN: Excuse me, Mr. Chairman. It seems to me that we are going over the same ground that we have gone over previously; that our order is for ceasing and abating the discharge from the present facility. And the plan which we have accepted in compliance with this order is for abandoning the plant, the existing plant, and operating in a new location, a new facility, with the required waste treatment facilities.

MR. HANSEN: I have in mind one of the statutory sections here talks in terms of no effective progress as a result of recommendations which have been made. And I would like to be able to inquire as to whether there has been a substantial progress or if further delays are going to be necessary, whether any change in this attitude on the part of New York can be anticipated.

MR. EASTMAN: You say that we said there is no effective progress?

MR. HANSEN: I believe this is one of the criteria set forth in the statute for action by the Secretary. I think this is something which is important for at least the conferees to be aware of as to whether or not there has been any effective progress taken since November 1968 or June of 1969 when the recommendations of the Acting Secretary were issued.

MR. EASTMAN: Well, I don't know what the opinion of the Secretary of the Interior is, but we have reported about the progress on the construction of the new plant. And the company has confirmed that they expect to abandon pulping operations and bleaching operations at the existing plant and transfer these operations to the new plant before the end of this year and also to immediately start changing the operations of the paper-making facilities which according to the order must be completed by July 1, 1971. And this seems to me to represent considerable progress.

I recognize that evaluation of what is effective progress may be subjective. You may have a different opinion than we do. But there certainly has been progress.

MR. STEIN: Are there any other questions?

(No response.)

Let me try to cut through. I think at least the words in our statute, as I recall, are if the Secretary in his judgment believes that reasonable progress has not been made, he shall take further action.

I think we have two problems here. One is the question of abating the source of pollution -- and I am just referring to International Paper now; it is coming from International Paper -- whether we believe effective progress is being made or if we are going to wait. Here, as I see the situation, all hands point to the fact that the pulping operation, which will contribute the major part of the waste, should be completed before January 1, 1971. But there may be some other parts of the operation in the old plant in Ticonderoga which may put out pollutants during all of 1971 and perhaps beyond. All I am asking is whether we believe that is sufficient progress?

The second question is what do we believe should be done about the existing sludge deposits, whose responsibility, and where we place the ball.

Now, again, there is one thing that I would like to zero in on. I am not sure that we need additional information except in one regard, which I shall bring up. But I think the Technical Committee has done a pretty good job. The Conservation Commission of New York may have some views; the Corps may have some views; Vermont may have some views; the Federal

Government may have some views; but I don't think any further study is going to reveal any new facts which are going to modify those views. The only new information, I think, we possibly may all need is the mercury content of the sludge, if any, which would affect its disposal in any way. I am not sure that that can't be gotten in fairly short order. But I would hope unless someone had a notion to the contrary, other than their mercury, we have adduced about all the facts that are necessary to make a decision.

There may be differences in judgment on where we go, but I am not sure that further study, except for the mercury investigation, necessarily is in order at the present time.

MR. EASTMAN: Mr. Chairman, I think to try to clarify New York's position, in our participation in the Technical Committee deliberations on the matter of rendering innocuous the effects of the sludge which now exists that we did not take exception. In fact, we fully support the need to render innocuous the present sludge as it now exists. The question was on which of the alternatives that were evaluated, and a cost estimate made by the Corps of Engineers, would most effectively achieve this objective. Is that clear?

We do believe, I think, as fervently as Vermont, it is necessary to render innocuous the sludge that now exists. The only question is about the selection of the alternative.

And, incidentally, in that connection, we have made admittedly a superficial attempt to determine mercury in the existing sludge bank. And as we have indicated previously, mercury just became a matter of concern very recently.

We took 2 samples. And one was 6 inches into the sludge bank and one was a foot into the sludge bank. And we found in the analysis of these results that there was only, I think it was, .8 of a part per billion concentration of mercury in these 2 samples. We acknowledged that this is a much too superficial sampling to determine really what the content, particularly of the older and deeper sludge, is. And I think that is a matter that we want to discuss further. And certainly this must be taken into consideration with regard to any alternative means for rendering innocuous the sludge banks that are present.

MR. STEIN: Are there any other comments?

MR. MILLER: Just one.

On page 3, Mr. Stevens, at the top when you concluded your reference to the anti-degradation policy of the State of New York, this states, and I am quoting, "In essence, this states that waters of a higher quality," et cetera. Do you consider this applies to the new IP plant?

MR. STEVENS: We indicated that this statement was adopted approximately 2 months ago whereas the permit was issued considerably prior to that.

MR. MILLER: You have no provisions in your administrative or legal procedure for amending your permits based on such action as this?

MR. STEVENS: No.

MR. MILLER: So that the permit having been issued prior to the adoption of this policy in your view, then, the policy will not apply to this case?

MR. STEVENS: As far as the construction permit is concerned, this is true. We do have operating permits, and there may be some inference as far as that is concerned.

MR. MILLER: What my question is essentially, is there any intention on the part of the State of Vermont or is that consideration being given to the modification of the existing permit based on the adoption of this anti-degradation position?

MR. STEVENS: Not on the basis of the position alone. This would be based entirely upon what effects were found in the lake after operation.

MR. MILLER: In other words, you are satisfied that the color of the effluent, the solubles, both nutrients and possibly dangerous solubles, the quantity of the BOD, will all be of a quality -- I mean from the engineering data that you now have will be all within the frame of this antidegradation policy?

MR. STEVENS: As I indicated, when we issued the permit, we indicated that we would meet the criteria set forth at the State line.

MR. STEIN: This is why I answered this, Mr. Miller. I think this is an important question. But we don't want any misunderstanding of this because I took such a short time. I got a very candid answer that didn't take very long from Mr. Stevens. But I think as far as I can see, they issued this permit before the antidegradation policy was adopted. And the effluent had gone several miles up the lake.

The criteria that New York State used was that they believed that effluent would meet the water quality requirements of Vermont and New York State. This does not mean that the water quality out there will not meet this antidegradation statement and not be of a little worse quality than it is now.

Is that a fair statement? It may or may not be. But they didn't judge it by these criteria. They judge it by the criteria that it would meet the effluent requirements.

Now, for example, let's suppose you had one, just to pick one -- and I am not saying this is the case -- you have got 5 mg/l of oxygen at the State line. Let's suppose you have 6 knots or 7 knots. The point is, by the issuance of this permit, what New York is guaranteeing is that you are going to have 5, not 6 or 7 if you happen to have that now.

MR. MILLER: I know it. And my question is a little redundant, and it has been covered, but I was very anxious to specifically refer to this and have the record a little fuller on this one, although I think you did cover it very well, Mr. Chairman.

MR. STEIN: Right. The people should recognize, I think, this is a significant point. Just because we go back and cover questions and answers, sometimes, as you know, in many of these situations you get important information just by one question and one answer. Unless there is a spark, you don't have to go through this. But I think the factual situation in the development is pretty clear.

Are there any questions?

MR. MILLER: We have no more.

MR. STEIN: Thank you very much.

Are there any further comments or questions from Mr. Stevens?

(No response.)

Thank you very much.

By the way, I would like to say -- and I mention this in solo voice to Mr. Eastman here -- as always, I am impressed by the quality of your prose. I recommend to the technical people that if they want to see a well-written technical report, a report that reads in English and deals with some arcane technical matters, they might use Don Stevens' technical reports as a model.

Thank you, Don.

Mr. Eastman.

MR. EASTMAN: As we indicated, we have a representative of the now Department of Conservation Division of Fish and Game, Mr. Paul Neth, who will give a statement.

STATEMENT OF
PAUL NETH
BUREAU OF FISH
NEW YORK STATE CONSERVATION DEPARTMENT

MR. NETH: Mr. Chairman, ladies and gentlemen, my name is Paul Neth. I am a supervising aquatic biologist working for the Bureau of Fish of the New York State Conservation Department. I am here to read this statement.

Paul Neth

The Conservation Department still has reservations concerning dredging in the decomposing sludge banks in the Ticonderoga area. Such operations can result in releasing oxygen-demanding substances which can cause rapid removal of oxygen in the water with consequent detrimental effect upon the aquatic life of the area. Seepage of such materials is generally slow in any stabilized bottom deposit.

Since the last meeting, it has been discovered that some fish in Lake Champlain are bearing mercury residues exceeding "actionable" levels set by the Food and Drug Administration. Although it is no longer used by the mill from which these deposits originated, mercury could be a significant component of these deposits since reportedly it may persist for long periods of time. Methyl mercury forms anaerobically in such sludges and is released to the water slowly. If stirring results in more rapid release, the concentrations in water could increase and higher residues develop in fish. Conceivably the concentration could even affect water supplies. It is recommended before further consideration is given to removal of this deposit by dredging, a thorough exploration be made of the deposit in area and depth for determination of the mercury content in the cored sludge.

Thank you.

MR. STEIN: Thank you, Mr. Neth.

Are there any comments?

MR. PAHREN: I have a comment.

You indicate in the first paragraph that there could be rapid removal of oxygen in the waters. Now, could you give us some kind of time period how long this adverse effect would be in effect? Is it just while the dredging is taking place?

MR. NETH: I would think that likely would be the case.

MR. PAHREN: We have heard testimony this morning that with the sludge in place, it may be years where we have deleterious effects, whereas you are indicating that there would be deleterious effects while dredging is taking place.

Now, we have heard testimony from Vermont that the dissolved oxygen gets down to zero in this area. So you cannot go any more than zero.

Now, do you feel that we have a proper balance here? On the one hand, we will continue perhaps to have zero with a resultant benefit of improved water quality over the years.

MR. NETH: Is the zero value found only over the sludge beds or is it found beyond them?

MR. PAHREN: As I remember, it was found over in Vermont.

Bill, you could probably speak to this.

MR. ALBERT: As I recall the data, we had essentially zero over the sludge bed, but we had half of a milligram per liter to three-quarters of a milligram per liter well over the sludge beds. And I have been informed by our fisheries people that this is hardly desirable.

MR. NETH: It is highly?

MR. ALBERT: Hardly desirable, not desirable.

MR. NETH: Again, I would think that the dredging activity would tend to expand the area of influence of the oxygen-demanding materials. In other words, it would not probably be confined to the immediate area of dredging which again would depend on wind action, wave action, currents of the material, of how the organic --

MR. STEIN: Would you have this notion about dredging even if mercury were not there?

MR. NETH: I am not familiar with our department's original position on this. I must confess I am filling in for a representative from our department who was supposed to attend, but couldn't make it. So I am not fully versed in what has transpired in the past.

MR. STEIN: Well, O.K.

I have two points here. If you think we should have a determination of mercury in the core sludge, one, if the conferees will decide to do that, will your department cooperate with us at least in selecting where we place the core samples so when we arrive at the judgment, we are going to say that the study was a valid one?

MR. NETH: This seems very reasonable.

MR. STEIN: Now, the next point, if the mercury is not found there in sufficient quantities, then you don't have the answer to the question. Even if we don't find mercury there, you are going to say that you don't want this sludge to be disturbed, but for other reasons. You are still reserving that position. I don't understand your position on this, whether it is just talk to the mercury content or whether you don't want the sludge disturbed, in any case.

MR. NETH: I would say at this stage, the mercury consideration is probably the overriding consideration.

MR. STEIN: By the way, I think that is a very helpful contribution. If that is the case, I think we have enough familiarity with mercury, at least we have enough federally and the other places, where mercury analytical stations are set up so that we can determine the amount of mercury in very short order.

Are there any other comments or questions?

MR. MILLER: Yes, please.

Go ahead, Bill.

MR. ALBERT: I was going to continue along the lines of Mr. Pahren's questioning.

Do I understand that your statement with respect to the oxygen losses from this disturbed sludge is temporary? Do you believe it will be of a temporary nature or semi-permanent nature? I am trying to extend this comment of which do we choose, the longer lasting low oxygen from the sludge or temporarily take a deficiency which when the sludge is removed possibly we can then put the lake back where we don't have an oxygen problem any longer.

In other words, this is a question of time here.

MR. NETH: It would be my opinion that it would be a temporary condition.

MR. ALBERT: And I gather that you will select the long-range problem of oxygen over a temporary oxygen problem. Is that my proper interpretation?

MR. NETH: Again, I don't have the background as to what has transpired in the past to really answer this for our department. I cannot answer it for the department.

MR. EASTMAN: Mr. Chairman, I think the controversy was over the selection of alternatives that were evaluated by the Technical Committee. And I believe that it was expressed by the Conservation Department representatives that covering with sand might be the preferred alternative as having less temporary adverse effect and at the same time achieving the same longer range goal of rendering the sludge innocuous.

Is that your understanding? It wasn't a position of choosing between doing nothing or dredging. It was a matter of deciding whether the alternative of covering with sand was preferable or whether the dredging was preferable?

MR. ALBERT: Thank you.

MR. MILLER: Mr. Chairman, I am sure you, like myself, have had considerable experience at expert testimony. I am very much perturbed by expert testimony that uses such words as "conceivably the concentration could even affect water supplies." I think our experts must tell us what their opinion is and should not raise just hypothetical possibilities. An expert is supposed to tell us, it seems to me, what is, indeed, a fact.

Now, I understand that you are pinch-hitting for somebody who is more familiar with this. But in layman's language, this area of the sludge and surrounding from the conservation point of view, am I right in thinking that it essentially is at present an aquatic desert? There is no life in there at all of any helpful or useful habitat for fish. It is pretty close to being an aquatic desert. Is that correct?

MR. NETH: Are you speaking of the area immediately over the sludge deposit again or adjacent to it?

MR. MILLER: I am speaking immediately over the sludge and within some distance surrounding it. But any opinion you are to give me on that would be much appreciated.

MR. NETH: I would think it is not a biological desert.

MR. STEIN: It isn't? What do they have if they have zero oxygen -- anaerobic material?

MR. NETH: I am sure you have bacteria that are able to survive under anaerobic conditions. I am not saying you will find fish in great abundance.

MR. STEIN: With zero degree oxygen or less than one part per million of oxygen, we are not going to find a biologic oasis.

MR. NETH: No, I will grant you that.

MR. MILLER: I used the phrase, Mr. Chairman, layman's language. And I am sure there are some loculi. You can find technical life there. But as far as the Lake Champlain and its general waters, how would you characterize it?

MR. NETH: As a fishery biologist, I wouldn't bother to set a net over the area.

MR. MILLER: So we are in agreement, really.

As I understand, we have maybe not too much experience with mercury, but we have considerable experience with the build-up of such compounds as DDT in the food chain, haven't we?

I say we have considerable experience in the build-up of such products as DDT in the food chain of fish, haven't we?

MR. NETH: Yes.

MR. MILLER: As I understand it, in the case of DDT, and I should imagine in the case of mercury, and I would like your opinion on this, this material has to get into the food chain to begin with, doesn't it?

MR. NETH: I think the basic pathway for mercury is through the food chain.

MR. MILLER: Very well. If there is no life there, if there is no food chain into which the mercury can get and thus get up the food chain into the fish, wouldn't you expect if we did a good, comprehensive job of the removal of this sludge to a reasonable distance beyond where the sludge is spread out, how do you anticipate any danger for mercury, then?

MR. NETH: Are you certain that mercury wouldn't be transported by water currents, wind and wave action, to other locations where it could be picked up by the organisms?

MR. MILLER: No, I am not.

MR. NETH: Essentially, what we are saying is we should look into the mercury situation in some depth. And again, I can't speak for the department's reaction beyond this point if low levels of mercury are found, I am sure they will review their previous stance.

MR. MILLER: I am just trying to bring this thing back into a proper proportion. I think your statement, if I read it correctly, stresses matters that would cause great alarm to the press and the public whereas, as a matter of fact, it seems to me that from what the Corps has told us about high speed dredge and what you, just a layman, can know about a vacuum cleaner or something pulling this stuff up, what we do know as a layman about how these compounds get into the food chain, I just wanted to do what I could to try to bring the statement that you presented here, I think, into a little better focus.

Thank you very much.

MR. STEIN: Thank you.

I think something should be pointed out, and possibly we are all coming to the same thing. I don't sense any disagreement that the sludge deposit should be taken care of and not constitute a source of pollution.

Now, as far as I can see -- and, of course, you have had a lot of fun with this about dumping sludge in other areas proposed by the Corps of Engineers -- that is an alternative. But it seems to me the two alternatives which are both lowest in cost and make sense are alternatives 3 and 4. Let me read these to you and show you where we face because I want to do this, gentlemen, on all sides.

And if you want to follow this, if you have this, get Mr. Bromberg's statement on page 3. And I think two of these alternatives are the ones we are going to look at both from price and effectiveness.

"Covering the in-place sludge deposits with a sand blanket" is one. Evidently some people in New York State think that must be the best. The Corps of Engineers presumably and the other members of the Technical Committee felt there were some kind of difficulties in covering with a sand blanket when you always have it in there and you don't know what is going to happen.

And, secondly, you have a difficulty -- an engineering difficulty -- in covering the sludge with sand.

The other point is "Construction of a dike in the shallow areas of Ticonderoga Bay. Hydraulically dredging deposits for disposal behind dike. After draining and consolidation of spoils, cover spoils with sand and topsoil for land reclamation."

Now, the point is you are going to get all the material out of here with the problem that in stirring this up, you may create a problem. So both of these in a sense have their disadvantage. Of possibly the four, they might have a short-run disadvantage, unless that were really effective in the lake. If you just were stirring up spoils, it would have a short-run disadvantage. Possibly, if it is stirring up mercury and the concentrations were high enough, there may even be a long-range disadvantage.

The other might have a long-range disadvantage because you are also sitting on top of it.

But let me give you the cost figures involved.

Covering with sand is $2,200,000.

Taking it out and covering it with topsoil and piling it behind the dike is $2,130,000. It costs about the same. In other words, we are not dealing with a difference in cost. As was indicated here, I think unless we have a complicating factor, with a heavy metal such as a toxic material like mercury that we are taking out, we have all the facts laid out on the table, particularly since the cost is about the same for both these. We have all the facts laid out on the table. The question is a policy judgment or an operative judgment on which one we are going to choose.

I don't think we are very far apart, as far as I could see, particularly as to the cost of the activity we have had in the area of toxic metals. I think New York State, the Interstate Commission, Vermont and we in the Federal Government are pretty attuned to the mercury problem. So we can get on with an analysis of what mercury is in there and see if it is insignificant at all.

Now, again, let me not try to oversimplify the problem. But I think the chances might be pretty good from the indication of the few samples collected, although they are admittedly just a very few, that we at least have an indicator. And the practices that we heard from International Paper that they were just using the mercury as a slimicide, I would feel, on the basis of my experience, that we might be optimistic that we might not find mercury in significant quantities there, what the scientist would consider significant quantities, if we are that lucky.

Then, we go back to evaluating these two alternatives and deciding which way we are going to go. Maybe first you decide who is responsible, and then maybe it will be their decision which one is going to go, because they have to come up with a program that is going to satisfy everybody. But I think before you really can make the determination, we may have to go through this relatively short-range mercury operation.

I don't think we need a further study. We can be on our way to make a judgment either to agree on how we are going to handle the sludge pile or not to agree. Is that a fair statement?

In other words, I think we are very close together in having all the facts in hand. There are just a few we don't have, and these relate to mercury. I think we can get them very fast.

Thank you very much for your statement.

And do you have any other?

MR. EASTMAN: Yes, we have some others. I have a card here indicating that Mr. Peter Paine wants to be heard. But he made a statement this morning.

MR. PAINE: Mr. Chairman, I would like to raise one specific question.

MR. STEIN: Why don't you come up.

STATEMENT OF
PETER S. PAINE, JR., GENERAL COUNSEL
LAKE CHAMPLAIN COMMITTEE
WILLSBORO, NEW YORK

MR. PAINE: That relates to the position of the Conservation Department. I don't want to add anything at all to what I have said this morning. But with your permission, I would like to make plain the position with respect to the possible location of the spoil area which I didn't mention this morning and which I think is rather relevant to some of these things you have just been talking about.

As I understand the position of the New York State Conservation Department in the letter that is attached to the Army Engineers' report and which forms part of the record, they do not wish to use as a spoil area this portion of the sludge deposits to the south, essentially, of the mouth of the Ticonderoga Creek, the reason being this is a valuable wildlife area. And I don't know how much wildlife is in there today. By God, I would imagine very little.

As I understand the Engineers' alternative, alternative #3, which you gentlemen have been talking about, it would be proposed to use this area roughly right in here as the spoil area.

Bear in mind Fort Ticonderoga is located immediately to the north of this. And I think there may be some problems from the standpoint of land use planning and the Fort's role and so forth and so on in using this as a spoil area.

So I would only like to say that I hope your committee, your conference, will consider the possibility of this side as well as this side. And maybe we lose a little bit from a wildlife standpoint and pick up something else from the land use standpoint. And I hope you won't foreclose alternate sites as a spoil area if you should decide to go route #3 as opposed to the sand.

That was my only point.

MR. STEIN: Any comments or questions?

(No response.)

If not, thank you very much.

Let me tell you the way I view this. I don't know how we are going to come out. As I understand this, practically all the spoil is on the New York side. If this should come out that this is a New York problem, I think New York is going to have to come up with the alternative, in the same sense, as I view it, as if we are dealing with any city or International Paper or anything else. In other words, the option has to be with the people who are going to be responsible to pay for it. If they are going to produce the water quality, that is the alternative the Federal Government and the adjoining State goes along with. As far as I understand, this is in principle.

In other words, if these areas that you are pointing to are on the side of New York State, it is up to New York State to make the judgment. But this activity will protect the interstate waters and protect Vermont. My principle is that this is a judgment for New York State primarily.

MR. EASTMAN: It sounds reasonable to me.

MR. STEIN: All right, good. Because, again, you people are citizens of New York State and, of course, you exercise your prerogative. But, again, I don't want to equate New York State with, say, International Paper or anyone else. But if International Paper has a problem, we ask International Paper what they are going to come up with as a plan, or we ask New York City, or Plattsburgh the same thing in order to abate pollution. If that plan is satisfactory, whatever they pick, if that is going to protect water quality, we approve it.

I think with reference to these remarks that were made this is essentially a New York State problem.

Are there any others?

MR. EASTMAN: Yes. Mr. Edmund Morette who is going to make a statement on behalf of the New York Conservation Council.

STATEMENT OF
EDMUND MORETTE, PAST PRESIDENT-DIRECTOR
NEW YORK STATE CONSERVATION COUNCIL
TICONDEROGA, NEW YORK

MR. MORETTE: Chairman Stein, conferees, I might be responsible for part of this hearing being held because I remember I made a speech November 13, 1968, at your conference where I asked -- and it is in the record -- that a study be made of the sludge deposits, the method of correction and the ultimate disposition of it and the estimated cost. And you have done it through the Corps of Engineers. And they are to be complimented on their study.

But the thing that I don't agree with -- and I might say that I am here on a day off so there will be no misunderstanding, I am here as a private citizen from Ticonderoga, representing the New York State Conservation Council; I am the past State president, and I am here specifically at the request of the chairman of our Water Pollution State Committee, Stanley Spisiak of Buffalo who gave Mr. Stein such a tough time in Buffalo yesterday at the hearing, I believe.

MR. STEIN: He gave me a little gold fish, too.

MR. MORETTE: Mr. Spisiak delivered a speech in Buffalo yesterday where he publicly announced -- I say that for the benefit of some of my friends here who have taken a little pounding here today -- he decided to sue Niagara Mohawk, I think, yesterday afternoon for dumping fly ash in one of the rivers at Dunkirk.

MR. STEIN: He decided the U.S. Attorney would sue Niagara Mohawk.

Edmund Morette

MR. MORETTE: So apparently we conservationists have been the devil's advocate, apparently, yesterday and today.

I think as I said before, and it is in the record -- I want to read it -- I think I was a little ahead of time. I think that what we have probably got to do is to sit down. I repeat what I said before that there are three agencies, which means the two States and the Federal Government and the paper company and the Village of Ticonderoga have got to sit down and get rid of the sludge and nobody else. Let us remove it.

And I think the Corps of Engineers has come up with four solutions which I don't agree with a damn one of them because I was there when they made the survey. I was down there on an average of three times a week with your man. And they were very competent men, but I can't understand my own New York State Conservation Department. I feel sorry for the gentleman that had to read the statement because he is one of my best friends, Paul Neth is. But he is a humble substitute for whoever wrote the statement that he has got.

I suspect who wrote it, but I can't prove it.

Just to switch back before I get down to mercury -- and I have got a lot on it, too, Murray, I will tell you that --

here is where we would like to see the sludge put. It is the cheapest way. It is the easiest method. And I don't know why they don't try to do it.

As the sludge comes down from the creek and it is formed here, going towards Fort Ticonderoga on the north, coming back into this giant marsh we have, and in front of the fort, we have a marsh here that there hasn't been a living thing in it in years. It has been destroyed. And this is the area that we believe where the sludge should be put.

Here is the sludge right here (indicating map). All you have to move it is 1,000 feet, 1,000 yards, maybe. It is too cheap, I guess, so they figured out every other method there was, but this sludge could be put into this marsh.

It has three boundaries now. The Route 22 goes right by it 30 or 40 feet above the marsh. The Delaware and Hudson Railroad goes this way which is another barrier.

There is a farm up here that forms the third barrier. So the only place that could fill this marsh up would be the creek.

All they have got to do is put that dike on this side of the creek. And that way we would have a confined area. And as things in there would try to leach back, the railroad which is nothing but cinders, it would leach through the railroad and take out most of anything that would be bad in it. And this is the cheapest and easiest.

But the Conservation Department has been led to believe that we have got a wild duck refuge there and tremendous amount of fish. That was 20 years ago, that statement was true, but not now. So I wish that you would try to convince the Corps of Engineers and the other people to go back there and take that area. And it will be the cheapest area and do the job and get rid of the sludge.

Now, the Conservation Council which means the fish and game club of the State of New York would like to see this sludge removed. I think that a suggestion has been made that the sediment should be tested, find out what mercury is in it, how much. And I am afraid you are going to find something else in it is my personal opinion, that is even worse than mercury.

I want to compliment Mr. Masterman. He took quite a ride. And he had to take an airplane out of here to get down to Glens Falls. I wouldn't want to be the vice president of the International Paper Company here today because Vermont has come well prepared, there is absolutely no question.

MR. STEIN: Think of those 364 other days.

MR. MORETTE: When I say Vermont has come well prepared, their staff and conferees are to be really complimented on preparing their ground work.

I feel a little sorry for Commissioner Eastman. I wish he had about 4 or 5 men also besides Mr. Stevens here because Mr. Eastman and Mr. Stevens seem to be outranked by those 5 or 6 Vermonters over there.

But I can remember, and I asked this question, and I just had it clarified to me, in 1965 a representative of the paper industry or a man who represented the paper industry in Washington was notified or people were notified that mercury was found in food packaging. And that is when International Paper Company and many other companies discontinued the use of mercury in their paper mills which is used to eliminate slime. That is what it is used for to the best of my knowledge in the paper mills.

MR. STEIN: They don't use that any more. That is not really modern practice.

MR. MORETTE: International Paper Company, as Mr. Masterman told you, stopped using it in 1965 or 1966, and many others have, too, Murray. I don't understand how the one at Plattsburgh is still using it. I don't understand it. But I am glad it was found out they were and they are going to stop using it.

But I want to get away from the sludge.

MR. STEIN: Before you get out of that, do you know a fellow by the name of Harold Benson?

MR. MORETTE: Yes, sir, I know him well.

MR. STEIN: Assistant Regional Supervisor, Fish and Wildlife, Region III in Ray Brook, New York.

MR. MORETTE: Yes, sir, I know him very well.

MR. STEIN: Zip Code 12977.

He wrote a letter on September 5.

MR. MORETTE: I have a copy of the letter, Murray.

MR. STEIN: That's right. To Mr. Haybrock in the Corps of Engineers. Here is what he says about that marsh. And we have to meet the facts when you say there is not a living thing. He says this marsh is productive of waterfowl providing several broods a year and also attracts ducks in the fall for hunting opportunity. The increased attractiveness of the lake waters for ducks sometime in the future after dredging would never compensate for the loss of the Ticonderoga Creek marsh.

MR. MORETTE: Twenty years from now if International moves up to their new mill and Lake George has a chance to flush out our creek and flush out this marsh, some of the things he is saying might be true. But at the present time, honest, Murray, and I think it is going to be taken care of a little later by Fort Ticonderoga that lives right across from this marsh. I will let them tell you what is in that marsh rather than I repeat myself. I want to get to mercury.

As has been explained by the Commissioner, there are three departments of State government investigating the mercury, and all releases will come from the New York State Conservation Department as I have been informed.

As many of you realize, much attention has been paid to mercury contamination for many years, especially in Japan and Sweden, mercury poisoning caused a drastic decrease of many bird populations in Sweden. Subsequently, it was found that freshwater fish in Sweden contained large amounts of mercury.

In this instance, methyl mercury was the form of mercury most commonly involved. Ample evidence exists that demonstrates that the methyl and ethyl mercury salts are extremely toxic and hazardous to living human beings, including man.

Here are some of the symptoms in case you think you have mercury poisoning. The symptoms in man of poisoning from mercury compounds may occur weeks to months after an acute exposure of toxic concentrations. The symptoms are usually numbness, tingling of the limps of the hands, of the feet, disturbances of your speech, concentrated constrictions of your visual field, impairment of your hearing and emotional disturbances. And if you drink very much, the symptoms are irreversible.

One characteristic of methyl mercury is its tendency to accumulate in the human brain. One of the observable effects of mercury poisoning in man is the impairment of the coordination of his muscle movements and also which results from damage to certain brain cells. After damage of one or two cells, the other cells may take over, the net result showing up as of no effect in a clinical investivation. But when too many cells have been damaged during a short time, the clinical results show up very early.

Now, the effects on aquatic life. A study of the relation between the concentration of mercuric chloride and a period of survival indicates that very small traces of this compound would be toxic to many species of fish if exposure continues long enough. Unfortunately, fish have shown no special ability to detect or avoid toxic concentrations of mercuric chloride.

A concentration of 2 parts per million also will cause the complete destruction of bacteria needed for sewage reduction.

Other forms of mercury are also toxic in small quantities to a wide range of our aquatic forms, but I want

Edmund Morette

to say here that organic mercury compounds are used in a wide variety of products. They have been used extensively to control slime in paper mills. And consequently, they may be present in discharged wastewaters.

In Sweden, regardless of the nature of the mercury pollutant, only methyl mercury has been found in fish, indicating that a methylization of mercury compounds takes place in the fish itself. It has been shown that mucus on northern pike is able to convert inorganic bivalent mercury almost completely into methyl mercury within a short period of 2 to 4 hours.

Thus, it appears that no matter what form of mercury is introduced into the aquatic environment eventually can be converted to the most toxic form which is methyl mercury. However, it has been demonstrated that fish in the aquatic environment can include mercury directly from the surrounding waters although the food must also play a role.

The concentration factor from water to pike is known to be in the order of 3,000 or more. As would be expected, fish-eating birds accumulate mercury, and they also have high values of mercury in the tissues, muscle tissues, of fish.

Most unfortunately, neither broiling, boiling or frying fish will serve to remove the methyl mercury accumulated in fish flesh.

I will tell you the source of all this information when I get done.

Some of the possible ways that a man can accumulate mercury are obviously from eating contaminated fish and other contaminated food as well as from drinking water. And as Mr. Stevens or Commissioner Eastman, I believe, said, it has turned out that drinking water standards of the United States Public Health Service and the World Health Organization do not include limits for mercury.

However, for over a decade, the maximum permissible concentration of mercury or mercuric chloride ions in the U.S.S.R., which means Russia, has been 0.005 parts per million.

I wanted to read to you those things about mercury that it is a dangerous thing, more dangerous than we realize. And I am glad that someone found it in Lake Champlain. A quartermaster found it up in Mississquoi Bay. A very good friend of mine in Canada whom I had the pleasure of talking to his staff yesterday, he found it in Mississquoi Bay in the northern pike.

We must do something about the sludge. I agree that the mercury should be tested out to see how much there is in the sludge and see if removing it would create a problem. I don't believe it will. I think if it is put in this marsh and confined, what little damage it will do while you are removing it will be far offset by the fact of leaving it there for how long we don't know. And I don't see any reason why we should have floating sludges and this gas floating around and all odors coming from that any longer. I think the time has come to move it.

I think our Congressman gave us a little encouragement, Carleton King, when we were in Washington talking to him about it that if we would develop this sludge marsh area into some sort of a recreation project which we think we can do, there is money available from the Federal people and possibly the State people, and I am sure --

Well, let's not use that word. I have no right to use it. But I honestly believe that a company that will appropriate $101 million to install primary and secondary treatment plants in all their paper mills in the United States would find another million or two if necessary if the proper people presented this problem to the president of the International Paper Company, Mr. Hinman.

Thank you very much.

MR. STEIN: And thank you, Mr. Morette, for your statement. I am glad to have that.

You didn't tell us where you got that information. Where was that? Reader's Digest?

MR. MORETTE: Murray, I hate to tell you of all people. This statement was prepared by Victor Lambou from the Federal Water Quality Administration in Washington, D. C.

MR. STEIN: It sounded like that bureaucratic stuff.

I am glad to have that statement. You know, we had one statement like that in one of the midwestern places where the governor had told the fishermen to watch out for this stuff. And the fellow got up and he said he told the sportsman not to ingest mercury.

MR. MORETTE: You are as sharp as ever.

MR. STEIN: Thank you.

Are there any questions?

MR. EASTMAN: Yes.

I think, Mr. Morette, you said you were an advocate for the devil.

MR. MORETTE: Advocate of what?

MR. EASTMAN: You said you were an advocate of the devil. On the contrary, I think you are an advocate of the angels.

MR. MORETTE: Thank you very much, Commissioner.

MR. EASTMAN: We have also a request from Mr. Edward Hamilton, Director of Fort Ticonderoga.

STATEMENT OF
EDWARD P. HAMILTON
DIRECTOR, FORT TICONDEROGA

MR. HAMILTON: I am Edward Hamilton, the Director of Fort Ticonderoga.

I first think it is only fair to amplify Mr. Williams' reports on Mount Independence. Mount Independence is one of the only two Revolutionary historic sites in Vermont. Mount Independence has been owned and preserved by Fort Ticonderoga for almost 60 years. And it is only very recently in the last 2 or 3 years that through the initiative of Fort Ticonderoga a Mount Independence Association was formed. And Ticonderoga leased the land to the State of Vermont for a dollar a year. And we operate it as a joint New York-Vermont corporation.

But I would like to bring out the fact that the preservation of that important site was due to Fort Ticonderoga.

I would like to clear for the record and have Mr. Bromberg show us on the map exactly what he proposes for the dike and the spill and the fill area for the sludge. Is

Mr. Bromberg still here?

I would like to clarify this for the record.

MR. BROMBERG: The statement I made this morning was I outlined an area submitted in the Corps of Engineers' proposal which suggested a possible site as this abutment here which I guess is just directly south of Fort Ticonderoga.

However, I concur with what Mr. Morette said. There is also a possibility of considering this area here (indicating) or possibly even the marsh which is on the northwest side of the railroad tracks which is in this area.

MR. HAMILTON: Thank you.

In other words, to put it on the record, this proposal of the Corps of Engineers would in effect destroy approximately half a mile of the southern shoreline of Fort Ticonderoga historic site.

Fort Ticonderoga is a restored colonial and Revolutionary fortress located at the junction of Lake George and Lake Champlain on the New York shore. It is recognized as a registered national landmark by the Federal Government and also by the State of New York which erected a large plaque at the entrance to the Fort and museum detailing Ticonderoga's contribution to this Nation's heritage.

The Fort is as much a part of Vermont's history as it is of New York's through Ethan Allen and his Green

E. P. Hamilton

Mountain boys.

The Fort and its garrison grounds were purchased from Union and Columbia Colleges by William Ferris Pell in 1820. Since that date, the fortress and its surrounding outworks and park lands have been preserved and restored, first by the Pell family and since 1930 by the Fort Ticonderoga Association, an entity established under the education law of the State of New York and charged with the responsibility of the continued preservation of both the historic and ecologic values of the area.

Fort Ticonderoga has always cooperated with the community and with the region. For example, land has been leased at a nominal fee of $1 per annum to the New York State Conservation Department to build a boat launching site on Lake Champlain for the convenience of local residents and visiting tourists.

We might add in addition that we have to build and maintain a mile-long road from the entrance of the park to the Fort. Absolutely no public funds have ever been received by the Fort from any Federal, State or local government.

The reclamation and preservation of historic values, as well as the enhancing of our naturally beautiful landscape, has been our immediate concern. We therefore, at this time wish to go on record as deploring the wanton industrial pollution of Lake Champlain and its shores some 2 miles of which is contiguous to Fort Ticonderoga.

We further wish to emphatically support the efforts to abate such pollution with the careful reservation for the preservation of all historic sites along that shore line.

We wish to go on record protesting most strongly against the suggested destruction of the southern shore line of Fort Ticonderoga. Any diking and filling in that area would ruin the original historic site which has been preserved by us and our predecessors for now 150 years. And it would be a tremendous shame to desecrate a national historic landmark which is visited by almost a quarter of a million people every year.

I thank you.

MR. STEIN: Thank you, Mr. Hamilton.

Any comments or questions?

MR. PAHREN: Maybe I should just make a comment for purposes of clarification to avoid misunderstandings.

The proposal of the Corps of Engineers at that site just south of the Fort is to put the spoil material there. However, this would be covered with sand. And then it would be topsoil on top of the sand and seeded.

MR. HAMILTON: Yes, but it would completely destroy a landmark. In other words, we have got a peninsula there which has been preserved intact for 150 years. If you do this, you will change the whole thing, destroy the southern shore line where the French and Americans had their landing stage. The French village is there, the lands in which the French troops camped. It is complete destruction of a large area of a historic site.

MR. PAHREN: All right. I want to make sure we both understand each other. I understand you now.

MR. STEIN: I could have told you that.

(Laughter.)

We need Mr. Hamilton to put a bur under our saddle.

MR. HAMILTON: Thank you.

MR. PAHREN: Secondly, Mr. Hamilton, since you work just a few feet away from this marsh that the New York Conservation Department set up survivial, from your observations, is this used extensively by waterfowl?

MR. HAMILTON: I should doubt it very much. I know every time the duck season opens, you will find a blind or two sitting out on that point, but that is, I think, much more for a transient duck population. In the first place, the water is foul there. How can the duck live there anyway?

There is another marsh to the north that is a nice duck breeding place and is free from pollution. But I am sure the duck breeding potentialities of that Wilson Bay are practically nil.

And we do feel that perhaps the loss of one or two broods of duck is less than the destruction of a national historic landmark.

MR. PAHREN: Thank you, sir.

MR. MILLER: I have one thing. Just a personal note, Mr. Hamilton. If you are still here when we adjourn, could I have a personal word with you?

MR. HAMILTON: Sure. Right, sir.

MR. PELOQUIN: Mr. Hamilton, with regard to the area shown in red on the map which Mr. Bromberg pointed out, the area to the west of Ticonderoga Creek, would there be any objection on the part of Fort Ticonderoga?

MR. HAMILTON: No.

I might just while I am here bring out one point. That is on the question of any wildlife. I do know they catch fish right there. Fish exist on the margin of that red area. That is a minor matter, but I make it a matter of record.

MR. STEIN: May I make a generalized judgment here? If we are faced with two plans, one to cover over the material that is lying in the lake and the other to put it in the site, and Vermont presumably wants it removed, what we are seeing here is what New York is going to be faced with and that we find all over. When you get a fill-in situation, you are going to have a dispute about the site. That dispute is going to go on and on and on as to where to put this. I think this in itself might be a factor affecting the decision.

So I would suggest that the people get together on your thinking in terms of the land disposal and dike area. I hope that you will get together and decide what your alternative is and where you want it.

MR. EASTMAN: We have two others who have indicated a desire to make a statement. One is Mr. Edwin Knox, Chief Engineer from Republic Steel Corporation.

Mr. Knox.

MR. KNOX: I did not want to make a statement. I have no statement to make.

MR. EASTMAN: I see.

And I believe the last one that I have here is Mr. James McKeown, Regional Engineer for the National Council for Air and Stream Improvement.

Mr. McKeown.

STATEMENT OF
JAMES J. McKEOWN, REGIONAL ENGINEER
NATIONAL COUNCIL FOR AIR AND STREAM IMPROVEMENT
TUFTS UNIVERSITY
MEDFORD, MASSACHUSETTS

MR. McKEOWN: Thank you.

Mr. Chairman, conferees, ladies and gentlemen, my name is James McKeown, and I am Regional Engineer for the National Council of the Paper Industry for Air and Stream Improvement, Inc. I am located at Tufts University in Medford, Massachusetts.

I am here today to discuss a certain publication which is titled "Studies on the Behavior of Benthal Deposits of Papermill Origin," and which was published as a technical bulletin No. 219 of the National Council in September 1968. I believe that the availability of the results of this study as embodied in the bulletin and discussed briefly here today should be of assistance to the conferees.

I would like to have the bulletin placed in the record of this conference.

MR. STEIN: Without objection, that will be done. It looks like a very excellent study.

(The above-mentioned report follows.)

national council

technical bulletin

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT INC 103 PARK AVENUE NEW YORK N Y 10017

STUDIES ON THE BEHAVIOR OF BENTHAL DEPOSITS OF PAPERMILL ORIGIN

JAMES J. MCKEOWN
ARTHUR H. BENEDICT
GERALD M. LOCKE

TECHNICAL BULLETIN NO. 219

SEPTEMBER 1968

national council
OF THE PAPER INDUSTRY
FOR AIR AND STREAM IMPROVEMENT, INC.

TECHNICAL BULLETIN NO. 219

STUDIES ON THE BEHAVIOR OF BENTHAL DEPOSITS OF PAPERMILL ORIGIN

The attached technical bulletin summarizes several years work on the benthal deposit problem at our Northeastern Regional Research Center at Tufts University, directed by James J. McKeown. A.H. Benedict and G.M. Locke participated in the investigation as Graduate Research Assistants in the Department of Civil Engineering.

Despite the rapid proliferation of sedimentation facilities throughout the pulp and paper industry for removal of settleable suspended solids, bottom deposits persist at numerous locations, and continue in fact to be formed to a limited degree, as a result of settled effluent interaction with receiving waters. Further, growing regulatory attention is being directed toward benthal deposits resulting from bark losses or river storage or transport of logs. The investigations at Tufts are therefore being continued with special emphasis on the behavior of simulated deposits composed of hardwood and softwood bark.

Your attention is called to the findings in the attached technical bulletin concerning the relative importance of deposit depth, exposed surface area, and flow turbulence in the overlying water in determining benthal oxygen demand, as well as to the successful efforts to correlate current findings with those of numerous earlier investigators. Particular note should be made of the findings concerning the beneficial effect of silt deposition in reducing the rate of benthal decomposition and oxygen uptake. This finding suggests that dormant deposits may become of minor significance through naturally induced silt coverage, and that their natural consolidation and coverage may be a preferable course of action than their artificial removal.

Very truly yours,

Ernest J. Bolduc, Jr.
Executive Secretary

EJB:lh
Encl.

103 PARK AVENUE · NEW YORK, NEW YORK 10017 · (212) 889-5416

TABLE OF CONTENTS

PAGE

I SUMMARY 1

II INTRODUCTION 1

  A. Origin of Benthal Deposits
  B. Nature of Benthal Decomposition

III REVIEW OF PREVIOUS INVESTIGATIONS 4

IV EXPERIMENTAL PROCEDURES 7

  A. Laboratory Systems
  B. Preparation of Benthal Deposits
  C. Experimental Conditions

V EFFECTS OF VARIOUS FACTORS ON BENTHAL DEPOSIT OXYGEN DEMAND 8

  A. Benthal Deposit Surface Area
  B. pH Adjustment
  C. Downstream Transfer of Soluble BOD
  D. Deposit Depth
  E. Mixing Conditions
  F. Preliminary Aging of Sludges
  G. Overlying Water Dissolved Oxygen
  H. Addition of Inert Sediments
  I. Dredging of Top Layer

VI DISCUSSION OF RESULTS 13

  A. General Observations
  B. Comparison with Previous Investigations

VII CONCLUSIONS 15

VIII BIBLIOGRAPHY 17

IX APPENDIX

STUDIES ON THE BEHAVIOR OF BENTHAL DEPOSITS OF PAPERMILL ORIGIN

I. SUMMARY

Organic suspended solids which settle and concentrate at the bottom of streams exert an oxygen demand on the overlying water. Using several types of laboratory reactors, studies were performed on the oxygen demand of processed wood fiber. Oxygen demand was found to be directly proportional to the surface area of the deposit and independent of deposit depth within the range studied. The uptake of oxygen was also noted to be a function of mixing extremes in the overlying water. The contribution of BOD_5 transferred from the sludge to the overlying water depended on the sludge compaction rate. Experimental conditions included constant presence of dissolved oxygen in the overlying water, batch deposition of homogeneous sludge, and constant deposit temperature.

II. INTRODUCTION

The term "benthal" is derived from the Greek word "benthos", meaning depth of the sea. It is employed in the field of environmental engineering to describe the conditions which exist at the bottom of rivers, lakes, ponds, lagoons, and other bodies of water. Thus, benthal organism, benthal deposit, and benthal demand are all terms describing certain aspects of this bottom environment. Use of the term benthal is therefore not restricted to the description of phenomena associated with pollutional effects alone.

A. Origin of Benthal Deposits

Bottom sediments may originate from either natural or man-made sources. Although deposits which result from the discharge of waste effluents are usually more significant in water pollution studies, natural muds may at times also play an important role. When effluents are discharged to a river, it often happens that in the region of discharge, or in some area downstream from the point of discharge, significant amounts of sediment accumulate as benthal deposits. The nature of these deposits will depend on the particular effluent released and on conditions prevailing in the receiving water.

If an effluent containing large amounts of settleable material is discharged to a shallow, turbulent stream, this insoluble matter will be suspended in the flowing water and, except for a small portion which lodges in crevices between rocks and in similar locations, will be transported downstream. As the river increases in size and the velocity decreases, suspended matter will gradually deposit on the stream bed as a benthal sediment. If the stream velocity in the region of discharge is insufficient to suspend the large insoluble particles, these will settle almost immediately. In either case deposition is subject to the same laws of differential settling which govern in a sedimentation basin.

If the effluent organic content consists solely of soluble or nonsettleable material, bottom sediments can still accumulate. During the course of natural purification, organisms living in the aquatic environment utilize the dissolved, colloidal, and very fine suspended matter present for their metabolism. This biological extraction and accumulation may result in the occurrence of biological flocs suspended in the water or in the establishment of attached growths on the stream bed.

In some cases chemical agents present in wastes discharged to a river may react to produce a precipitate, or may act as coagulants to flocculate colloidal and fine suspended matter. The type and amount of sludge that will accumulate in this manner depends on the nature and amounts of the effluents and on physicochemical conditions in the stream.

Natural processes can also result in the formation of bottom deposits by deposition of leaves, twigs, dirt and similar debris in low velocity regions such as estuaries, marshes, bogs, and swamps where decomposition occurs. In fact, the term "marsh gas" which is often applied to methane is derived from the evolution of this compound in these stagnant waters.

Although the sources of benthal deposits are discussed separately, most actual sediments result from a combination of many, if not all, of the processes outlined.

B. Nature of Benthal Decomposition

The term "benthal decomposition" encompasses all of the mechanisms and associations involved in the stabilization of organic material within a sludge deposit. It is a complex phenomenon involving both the aerobic and anaerobic degradation of organic matter. Generally, a benthal system is divided into a water layer and a sludge layer, the latter being further divided into an aerobic zone and an anaerobic zone. The overlying water may or may not include a zone of oxidation.

Within the aerobic zone, aerobic bacteria utilize the dissolved oxygen for their metabolism and thus create an oxygen demand on the overlying water. In very shallow deposits this zone may include a large proportion of the total depth, whereas in deep deposits it is probably present only as a superficial upper layer.

The microbial action in the anaerobic zone is similar to that which occurs during sludge digestion. Within this layer solid material is hydrolyzed to liquid products, and these in turn are converted to gases. The gaseous products accumulate as small bubbles on the solid material, while the liquid products remain in the voids. As decomposition proceeds and gradual consolidation takes place, oxidizable liquid wastes may be forced upward through the sludge and into the receiving water, thus creating a further demand on the oxygen content of the flowing water.

Gas may accumulate in sufficient quantity to overcome the forces holding the sludge together, and bubbles will then rise through the sediment and overlying water. In so doing, the bubbles will resuspend oxidizable solid material from the anaerobic layer and will also create a passage for more oxidizable liquids to rise into the flowing water.

In some cases a zone of oxidation may occur. Since the water near the sludge surface is in more intimate contact with oxygen demanding material than that near the air-water interface, an oxygen gradient may well be established. If the point of zero dissolved oxygen (DO) falls below the sludge-water interface, the aerobic zone previously discussed will be present. If, however, this point lies above the sludge surface the entire sediment will be anaerobic, and this condition will extend also into the overlying water.

Whether or not a well-defined gradient is present depends on (a) diffusional mechanisms, (b) conditions in the overlying water, and (c) the characteristics of the decomposition process. If conditions are such that significant mixing action is present in the flowing water, this gradient will probably not develop. If, however, the deposit is located in an impoundment where quiescent conditions prevail, the establishment of such a gradient is usually evident.

III. REVIEW OF PREVIOUS INVESTIGATIONS

The accumulation of organic deposits in streams, rivers, lakes, and other bodies of water affects the physical, chemical, and biological properties of the aquatic environment. On the other hand, the receiving water itself influences deposition and the nature of the deposit by (a) removal of certain constituents by natural elutriation; (b) flocculation of nonsettleable particles; and (c) hydraulic selection of particles through differential settling.

As in sedimentation, the hydraulic characteristics of the stream affect the bottom sediment. When the stream velocity reaches a certain critical value, scour occurs, resulting in the resuspension and relocation of deposited material. The velocity required to cause scour is usually greater than that which permitted settling of the deposited material because the flowing water must overcome compaction force within the sludge mass. The critical velocity necessary for scouring of organic material is defined as follows:

$$V_c = [8Bg\ (s-1)\ d/f]^{1/2} \ldots\ldots\ (1)$$

where:

V_c = mean channel velocity necessary for scour, ft/sec

d = particle diameter, ft

B = a constant

g = acceleration due to gravity, 32.2 ft/sec^2

f = Darcy-Weisbach friction factor

s = specific gravity of the particle scoured

The factor B reflects to some extent the sludge characteristics. Thus, compaction and consolidation tend to increase B (increasing V_c), while gas production within the sediment increases agitation and tends to decrease B. Generally, scour may be expected to occur at mean channel velocities between 0.6 and 1 fps.

Early investigations employed laboratory reactors containing sewage sludge to determine the effect of benthal deposits on oxygen resources. Baity (1) in 1937 examined several shallow sewage sludge depths, ranging from 0.5-4.0 cm. The sludge contained 8.5 percent total solids of which 85 percent were volatile.

Baity postulated a depth function approximating a parabola as follows:

$$y = 2700\ x^{0.485} \ \ldots\ldots\ldots\ldots\ldots \quad (2)$$

where x = sludge depth (cm)

y = rate of oxygen demand (mgO_2/m^2/day)

Extrapolating this curve shows little change in rate of oxygen demand per unit area at depths greater than 10 cm. Baity also fitted his data to the Phelps (2) temperature relationship with good results. Experiments showed that complete stabilization of thin sludge films (less than 0.1 cm) was accomplished in about thirty-six days. Fair (3), in 1941, using a lower concentration of sewage sludge, investigated depths from 1.5-10.2 cm and proposed the following relationship based on the weight of volatile material per unit area:

$$y_{s_{o}'} = 2.45\ m^{0.485} \ \ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

where $y_{s_{o}'}$ = initial rate of oxygen demand (gms O_2/m^2/day)

m = areal concentration of volatile matter (kg/m^2)

Fair showed that the time required for 50 percent reduction in demand rate was in the order of 0.3 years for the depths studied.

Rudolfs (4) carried out studies on the BOD$_5$ of comminuted and screened sewage sludge as well as activated sludge. The decanted liquor and the sludge showed a marked BOD$_5$ reduction with time. Initial BOD$_5$ of the sewage sludge was in the order of 0.5 gms BOD/gm volatile matter and was reduced to 0.1 gms BOD/gm volatile matter in 300-360 days. A rapid rise in sludge pH accompanied the high rates of BOD$_5$ reduction.

Bloodgood (5), using a system of continuous daily deposition of strawboard paper waste, showed that the oxygen demand that was transferred to the supernatant water reached a constant value after 25 days, while sludge depth continued to increase. Additional studies showed that aerobic conditions in the overlying water nearly doubled the oxygen demand when compared to a similar anaerobic system.

Mixing sludges with water and comparing the oxygen uptake with undisturbed systems was also investigated (5, 6, 8). As expected, oxygen utilization was significantly greater in the mixed reactors as compared with an undisturbed interfacial condition.

Knowles *et al* (7) studied the uptake of 8 cm deep cores obtained from several river bottoms and showed that oxygen consumption was related to DO concentration in the 1-4 mg/l range. Oxygen demand generally was independent of DO at DO concentration above 3.0 mg/l. Edwards and Rolley (8) found that benthal demand dependence on oxygen concentration for certain river muds between the limits of 2 to 10 mg/l DO could be described as follows:

$$y = a_3C^b \text{ ....} (4)$$

where C = DO in the overlying water (mg/l)

y = oxygen consumption ($gm/m^2/hr$)

a and b = constants

Studies by these authors showed that oxygen consumption was independent of sludge depth between 4-17 cm for cores obtained from two streams. Downing (9) estimated that British streams with a depth of 2.0 meters and a velocity of 0.03-0.15 m/sec have a bottom mud respiration rate between 0.6-4.8 mg/l/day.

Lardieri (10) using acidic mud collected from a stream below a paper mill showed that adjustment of deposit sludge to a pH of 7.0 approximately doubled the oxygen demand. Sludge collected 5 ft. below the surface of the bottom deposit exhibited a rate equal to that of the deposit surface. Stein and Dennison (11) using a submersible bell unit, measured the in situ demand of a cellulosic sludge deposit below a sulfite pulp mill as well as a control area in saline waters. The in situ measurement showed oxygen utilization to be 3.60 $gms/m^2/day$. Laboratory studies of the same deposit showed increased demands ranging from 5.01 to 5.93 $gms/m^2/day$. Control areas exhibited demand rates of 1.11 $gms/m^2/day$. It was reported from the laboratory investigations that oxygen consumption was independent of sludge depth.

Hanes and Davison (12) showed a near-linear relationship between oxygen demand and deposit depth for cellulosic slu-sludge during compaction using a short term laboratory reactor. The relationship was not carried beyond 29 cm depth. Additional studies carried out after sludge compaction ceased indicated oxygen demand was independent of depth in the range of 1.5-25 cm. Oldaker et al (13) using muds collected from a Massachusetts stream concluded that benthal demand varied with age and depth of the deposit. According to this study, only the upper 15 cm of sediment had a significant effect on the areal oxygen demand.

Hanes and White (14) studying the short term influence of salinity have concluded that there is a slight increase in oxygen uptake rate of a cellulosic benthal system with increased concentrations of sea water. Baity (1) using sewage sludge showed a lowering of the oxygen uptake under saline conditions. McDonnell and Hall (17) examined stream sludge samples in a short term mixed reactor. Benthal depths of 2-25 cm were investigated. Oxygen uptake rates were reported to be a function of oxygen concentration and independent of depth. The presence of macroinvertebrates were found to have a significant effect on increasing the uptake rate when compared to normal bacteriological systems.

IV. EXPERIMENTAL PROCEDURES

A. Laboratory Systems

The laboratory systems used in this study were all batch systems with respect to the bottom deposit. Unless otherwise noted, no further solids were added to the deposit. The systems used were both continuous and batch with respect to the overlying water.

The continuous flow system was of the tube variety as shown in Figure 1. Various lengths of 2.5" I.D. (6.35 cm) tubing were used as benthal reactors. Each experimental run was accompanied with control tubes of equal length containing test water only. Flow was controlled by vertical adjustment of the outlet capillary.

The batch flow reactors are shown in Figure 2. Both a short term (0-48 hrs) shallow reactor and a series of long term reactors were used. Water was either distilled or tap water, fortified as standard BOD dilution water (15) and was replaced daily. The initial sludge was seeded while the overlying water depended on the sludge for seed. Dissolved oxygen concentrations were measured using the Winkler method Azide modification as well as the dropping mercury electrode polarographic method. A galvanic membrane cell was used to trace the dissolved oxygen content in the short term mixed reactor.

B. Preparation of Benthal Deposits

Two types of sludge were used in preparing the bottom deposits, (a) a diluted vacuum filter cake obtained from treating the clarifier underflow from a paper mill treatment plant, and (b) the clarifier underflow from a plant treating paperboard mill wastes, in a separate series of studies on depth.

The sludge was prepared so as to simulate stream deposition, and to allow for some practical laboratory considerations. The raw sludge (either filtered or settled solids) was washed with distilled water containing BOD dilution water chemicals as well as 4 mi/l of river water as seed. Solids concentration was then adjusted to between 3-4 percent total solids. Three such washings were performed allowing the solids to settle and withdrawing the supernatant each time. These washings were designed to remove soluble and absorbed constituents as might be the case in a stream where the solids had been suspended initially in the flowing water prior to settling into a benthal deposit. Following this procedure, the suspended solids would now contain a certain amount of seed, and the water within the interstices is presumably standard dilution water.

During certain experimental trials the sludges were also buffered using $CaCO_3$ after initial adjustment with NaOH. Simple pH adjustment was accomplished using NaOH where indicated. The vacuum filter cake was either used fresh or was stored for 3-6 months prior to use and is denoted as fresh or aged sludge. The clarifier underflow sludge was used fresh in the depth study. Dissolved gases were stripped from the final sludge sample before placement in the reactors. Stripping was by no means complete but the sample was evacuated for 5-10 minutes to remove gases entrained with the sludge during washing and makeup procedures.

C. Experimental Conditions

Temperature was controlled in all cases. In the horizontal tube trials and the short term vertical reactor, the temperature was maintained at 20°C ± 0.5°C in a walk-in incubator. Water was stored for 1-7 days at incubator temperature prior to its use. The temperature in the depth study was controlled between the extreme limits of 19-22°C with an average of 20.5°C.

The primary test condition was to maintain aerobic conditions in all reactor waters overlying the benthal deposits. At certain times, due to malfunction of equipment or extremely high oxygen demands, anaerobic conditions did occur. However, when discovered, these conditions were immediately corrected.

All deposits placed in the reactors were initially homogeneous. This is certainly not the case with many such deposits in existence. Stratification due to periodic scouring, compaction with depth, as well as layering of various types of materials, is the normal condition found in streams. Although in certain experiments attempts are made to duplicate these natural occurrences, it should be pointed out that actual heterogenous deposits might not necessarily behave like the homogeneous deposits used in the laboratory studies.

V. EFFECTS OF VARIOUS FACTORS ON BENTHAL DEPOSIT OXYGEN DEMAND

A. Benthal Deposit Surface Area

Although the overall effect of benthal deposits on the oxygen resource of a stream involves some degree of speculation, the literature is relatively clear on the effect of surface area of mud/water interface. All other conditions remaining equal, an increase in the surface area of the deposit will show a proportionate increase in the overall oxygen demand. Thus, many authors report benthal oxygen demands in terms of surface area (i.e., $gms/m^2/day$).

Initial trials performed to validate the applicability of the experimental apparatus, as well as to demonstrate the effects of using BOD dilution water, as compared to distilled water, are shown in Figures 3 and 4. Using distilled water alone, relatively low rates of oxygen demand were noted, but the above surface area relationship was readily demonstrated, as shown in Figure 3. Altering the chemical content of overlying water to provide a conducive environment for biological growth, as shown in Figure 4, produced an approximately 400 percent increase in daily demand. It is interesting to note that, upon discontinuing use of BOD dilution water, the demand remained high and started to decrease slowly. This demonstrates both the rapid response of bottom organisms to beneficial growth conditions in the overlying water as well as the ability of the mud to absorb materials in the overlying water, thereby prolonging such conditions once inorganic nutrient feed was terminated.

B. pH Adjustment

The effect of raising benthal pH into the neutral range has been reported as responsible for doubling the oxygen demand rate of such deposits (10). Several trials were performed using relatively shallow depths where sludge pH was adjusted, buffered, or left unadjusted.

Trial I summarized in Table 1 shows the effect of buffering (1.0 gm $CaCO_3$/100 mi sludge) on maintaining a near neutral pH throughout the duration of the experiment. The sludge whose pH was adjusted to 7.1 with NaOH and the unadjusted sludge produced final pH values as influenced by the overflowing water. The relatively low uptake rates shown in Trial I resulted from use of relatively low proportions of BOD dilution water in this run. During the 90-day trial, half-strength BOD dilution water was used. Laminar flow conditions which produced little or no mixing, plus the shallowness of the deposit, are also believed responsible for the low order of oxygen uptake. However, the increase in uptake rate was on the order of two to threefold as a result of maintaining near-neutral pH. Trial II represented full strength dilution water overflowing the benthal deposit and showed a greater than twofold increase in oxygen demand rate due to the pH effect.

Trials were also performed using the Warburg respirometer to demonstrate the pH and buffering effect. Figure 5 shows the uptake rate of samples placed in BOD bottles at the start of a tube trial and sampled at days 14, 37 and 84. Of significance here was the difference between the buffered sludge and the unadjusted or simply neutralized sludge. Overlying water was replenished in the BOD bottles, thereby simulating the tube study.

C. Downstream Transfer of Soluble BOD

The degree to which soluble BOD is added to the stream as a result of leaching from benthal deposits was studied in several trials. One such run was made by simply attaching a downstream tube in series with one which had an active bottom deposit. Figure 6 shows the total cumulative uptake of the single tube containing the benthal deposit and the total system containing benthal tube and downstream section. It appears that the bottom deposit, having been aged for 110 days, yielded an essentially zero contribution of soluble organics to the overlying water when compared to the surface action over the deposit. Similar results were obtained using the long term batch system shown in Figure 2. These results are given in Table 2. The BOD released to the overlying water decreased with age of the deposit. After ten days of aging in the laboratory columns, the BOD load added to the overlying water from the deposit was on the order of 0.4 gms BOD_5/m^2/day. Initial values were 10-20 times that of the ten-day old deposit. Buffered sludges initially released greater concentrations of BOD than their acidic counterparts.

D. Deposit Depth

Studies using the flow-through tubes were limited (due to diameter) as to the range of depths which could be investigated. Also, curvature of the tube bottom actually produced a varying depth from sidewall to center of the tube. Vertical columns having initial sludge depths of 1, 2, 3, and 4 feet (0.305, 0.61, 0.915, and 1.22 m) were used to investigate the depth function. Two additional variables, namely, mixing velocity and sludge pH, were superimposed on the depth study. Table 3 summarizes the data from this investigation. No attempt was made to regulate the stirring condition from day to day or maintain constant stirring from column to column. Magnetic stirrers were kept at preset dial markings, but as pointed out in another study (18), precisely uniform mixing conditions were not maintained. During the normal mixing situations, two screens were inserted in the columns. One screen was directly above and in some cases rested on the sludge surface. The second screen was placed about 15 cm below the mixer located at the top of the column. After the first few days' operation, the overlying water remained clear. During the mixing condition characterized as scouring, the top screen was removed from the columns. Visible evidence of resuspension of sludge as a result of vortex action at the center of the column was observed and described as scouring.

Regardless of the zone of mixing, the columns showed no significant relationships between oxygen uptake and sludge depth within the range of 1 to 4 feet (0.3-1.2m). Figures 7a and 7b show the cumulative uptake of unbuffered and buffered columns.

E. Mixing Conditions

The effect of turbulence or flow rate above the deposit was investigated using both the horizontal and vertical tube apparatus. Figure 8 shows that a doubling of flow rate within the laminar range using the horizontal tube caused little or no change in uptake rate over the benthal deposit. However, when flow became turbulent to the point of creating scouring velocities, a considerable increase in demand was exerted, as shown in Table 3 and Figures 7a and 7b. In the vertical columns, the uptake rate increased from 2.7 gms O_2/m^2/day to about 4.4 gms O_2/m^2/day as a result of partial scouring of the deposit. Stagnant conditions produced uptake rates in the order of 0.8 gms O_2/m^2/day which are within the range of previous laminar flow tube results.

F. Preliminary Aging of Sludges

Studies using the horizontal tubes having a thin layer of sludge (mid-depth 0.8-2.1 cm) generally showed a lag period followed by a high rate of oxygen demand which lasted about 30-40 days. The peak demand period was then followed by an extended period of lower demand. A further differentiation between fresh and aged sludges was noted in the trials. (Fresh sludge was that collected immediately prior to a run, by vacuum filtration of settled paper mill waste. Aged sludge was the same sludge stored for 2-6 months prior to its use). Table 4 shows the initial or peak demand of sludge compared with the later phase. These data represent runs lasting 50-100 days. In general, the daily demand curve was similar to that shown in Figure 9. Secondary peaks of lower magnitude were not uncommon in the continuous flow studies. The general nature of the oxygen demand during the later stages of the trials showed a gradual decrease. The Warburg respiration rates presented in Figure 5 also show the decrease in uptake rate with age.

G. Dissolved Oxygen

No specific overlying water studies were conducted to determine the effect of dissolved oxygen in the overlying water on the demand of the benthal deposit. In all investigations, waters entering the reactors were near saturation concentrations. However, as would be the case with an actual stream, the dissolved oxygen concentration decreased as the water flowed across the deposit or remained in the reactor. Figure 10 shows the variation in DO with depth near the end of the horizontal reactor. The gradient exhibited indicated the difficulty involved in attempting to determine if the DO content in the overflowing water is related to the demand of the deposit. The batch reactors presented the same type of problem although mixing was more complete. DO decreased during the course of the run and was actually zero after 24 hours on certain occasions. However, samples removed after 16-20 hours detention the following day contained DO. The daily demand did not seem to be affected by brief periods of zero DO in the overlying water.

H. Addition of Inert Sediments

In certain portions of the study, sand was either mixed with or placed over the deposit to determine the effect of altering the volatility of the material at the surface. The study involving the mixed sand condition was carried out in the horizontal tube reactor. Table 5 shows the results.

TABLE 5

COMPARISON OF MIXED AND STRATIFIED BOTTOM DEPOSITS

Sample	Oxygen Uptake Rate (mg/day)		
	0-24 d	24-60 d	60-95 d
300 mi sludge placed on 300 mi sand	3.5	8.6	4.1
300 mi sludge mixed with 300 mi sand	3.5	4.6	5.0

Short term studies using the small, short term mixed reactor indicated that covering a 1.0 cm sludge deposit with 1.0 cm of sand reduced the oxygen demand from 0.82 gms O_2/m^2/day to 0.46 gms O_2/m^2/day in the initial phases of decomposition. Thus, inert sediment either mixed with or placed over the cellulosic sludge was observed to reduce benthal oxygen demand.

Using the deeper batch reactors, the deposits were covered with 1.5-3.0 inches of sand after a period of normal and turbulent experimental conditions. Figure 11 shows the effect of adding the sand layer on the oxygen uptake rate of the deposit. In both tubes the added sand compressed the sludge considerably. The unbuffered sludge compressed from 23 inches to a final depth of 15 inches. The sand added to the buffered system penetrated the sludge and a second sand layering was added to completely cover the surface. As a result of the compression, both systems showed a rise in demand immediately following the placement of sand. The buffered sludge which showed the greater compression produced a three-day period during which daily oxygen demand increased by 60 percent. Both systems, however, settled down to lower demand rates after the initial rise, representing a 35-43 percent reduction in demand rate compared to the unsanded surface.

I. Dredging of Top Layer

The vertical tubes initially containing 3 feet (0.915 m) of sludge covered by 2 feet (0.61 m) of water were altered after 40 days of system age. The top 1.0 feet (0.305 m) of sludge was carefully removed from these tubes leaving 2 feet (0.61 m) of sludge covered by 3 feet (0.915 m) of water. Figures 7a and 7b show the cumulative oxygen uptake with time after the simulated dredging operation. In both buffered and unbuffered systems the newly exposed sludge surface displayed oxygen demand rates essentially equal to that exhibited prior to removing the upper third of the deposit. The sludge removed from the tubes showed the entrained water to have a BOD_5 of 245 and 750 mg/1 from the unbuffered and buffered systems respectively.

VI. DISCUSSION OF RESULTS

A. General Observations

The sludge removed from the vertical tubes was analyzed for total solids and pH. Liquid extracted by filtration from the sludge was analyzed for BOD_5. These results are presented in Table 6.

1. Changes in pH and Volatile Solids Content - All sludge in this study had an initial total solids concentration of 3.67 percent and an initial total volatile solids of 3.05 percent. Thus, initially 83 percent of the total solids were volatile. Compaction and resulting leaching in addition to oxidation reduced the volatile solids content to 77 percent, excluding the sanded surfaces. Analysis of the sanded surface was performed on a sample from which most of the sand was removed. pH near the surface was influenced by both overlying water as well as underlying sludge. pH at the bottom of the sludge deposit clearly shows the results of buffering.

2. Changes in Interstitial Water BOD_5 - BOD_5 analysis of the liquor entrained with the sludge indicates a general increase from surface to bottom with the exception of the sanded column which showed proportionally greater solids compaction at the surface. The 4 foot (1.22 m) deep sludge column which was buffered developed a substantial leak near its bottom near the end of the study resulting in considerable loss of original liquor which presumably was replaced by infiltration of overlying water. Thus, the BOD_5 values are considerably lower throughout the sludge depth in this column. In general, however, the buffered sludges developed a liquor with a significantly higher entrained BOD_5 than the unbuffered systems. Considering that there was no significant difference in BOD_5 transferred to the overlying water after the initial few days, it is assumed that the underlying BOD is retained within the deposit and undergoes anaerobic decomposition.

3. Miscellaneous Physical Observations - Sludge placed in the horizontal flow-through systems produced noticeable slime growth at the sludge-water interface during the long term studies. Although the organisms were not typed, a representative example of the predominant forms is shown in Figure 12.

In every long term study using both flow-through and batch reactors, a distinct darkening of the deposit took place at the surface. Shallow and deep systems containing 0.8-122 cm of deposit showed a clear distinction in coloring of the surface when compared with the underlying sludge. Figure 13 illustrates the surface condition compared with the bulk of the deposit. Generally, darkening became evident between 20-40 days of system age.

4. H$_2$S and Gas Production - Gas production was observed intermittently in almost all systems. Buffered sludges produced gas on more occasions than unbuffered sludges. However, sludge bulking was not severe in either flow-through or vertical reactors. One vertical column containing a 4 foot deposit did show 1" (2.54 cm) separation of sludge which was held in place by the screen and eventually resettled. Gas production was measured but was found so intermittent and of low volume that the measurement was discontinued.

Hydrogen sulfide odor was very evident during the dredging operation in the tall columns and upon final removal of the sludge for analysis. Sulfide liberation was judged more severe in the buffered sludges than the unbuffered sludges. However, malodors were never present from day to day in aerobic waters removed from each column.

B. Comparison With Previous Investigations

Comparing data for different types of waste and stream sludges examined in a variety of laboratory reactors is obviously difficult. An attempt, however, was made to tabulate data from nine investigations in Table 7. Some areas of general agreement were noted. These may be listed as follows:

1. Depth - Several investigations indicated a relationship between deposit depth and oxygen uptake (gms/m^2/day) of the deposit. However, three factors are believed to account for such observations as follows:

(a) Compaction or compression of the bottom deposit is believed to have taken place in several of the earlier studies, during which time oxygen utilization was being cumulatively added. Thus, the rates computed in much of the early work included a substantial period of uptake due to compression and leaching of soluble oxygen demanding materials to the overlying water.

(b) Some of the sludge samples (17) obtained from streams contained quantities of macro-invertebrates which may have contributed significant oxygen demand in addition to the bacteriological oxygen demand.

(c) Exceptionally shallow (thin film) deposits may display a demand: depth relationship, since the depth of the interface between aerobic and anaerobic conditions has not been clearly defined.

Therefore, leaving aside such cases, studies of aged deposits undergoing stabilization(and where additional deposition is no longer taking place) indicate that oxygen demand is independent of sludge depth.

2. Volatile Solids Content - Consideration of the quantity of organic material in the deposit produces a relationship shown in Figure 14. Considering the areal concentration of volatile matter versus the uptake of oxygen per weight of volatile matter provides what appears to be a significant generalized relationship. The obvious problem is in choosing a demand rate at low solids concentration conditions or in determining a rate for deep compacted deposits, where it has been observed that depth has no influence.

Although the generalized relationship appears reasonable, Figure 15 indicates the magnitude of discrepancy that is involved in using such a relationship. Certain of these data can be explained. Oldacker et al (13) used a sludge that was highly non-volatile. The volatile solids amounted to only 2.76 percent of the total solids. Most other data was representative of sludge having greater than 50 percent volatile material. Thus, the character of the sludge can be an important limitation in extrapolating these data to field conditions.

A second qualification is the age of the deposit. Conceivably, in some cases equilibrium had not been reached with respect to transfer of soluble BOD into the overlying water and thus somewhat higher demands were obtained as shown. Therefore, for aging deposits, the rationale of basing oxygen demand solely on volatile solids is questionable. The general 1:1 slope produced by several of the studies provides further evidence that oxygen demand is independent of depth and primarily related to surface area of the aging deposit.

3. Surface Area - The data exhibited in Table 7 show that regardless of type, age, or origin of sludge used in the various studies that the maximum oxygen uptake is generally less than 6.0 gms/m^2/day. Further, deposits which are believed to have reached equilibrium with respect to sludge compression and which contain at least 50 percent volatile matter, show an oxygen uptake in the range of 1.5-5 gms/m^2/day. Long term studies conducted using cellulosic deposits indicate oxygen demand to be in the order of 2-3 gms O_2/m^2/day for flow conditions approaching scouring.

VII. CONCLUSIONS

Laboratory studies have been conducted on the oxygen demand exerted by cellulosic benthal deposits. The conditions imposed upon the study were such that the deposit was initially homogeneous, continuous deposition had ceased, the overlying water contained dissolved oxygen, temperature of the system was constant, and mixing was controlled. The following conclusions are presented:

1. Uptake of oxygen by benthal deposits is directly proportional to surface area of the deposit and this rationale is believed to be most applicable to deposits of cellulose origin.

2. The BOD_5 transferred to the overlying water decreases with time and in the case of shallow deposits was essentially zero after 100 days exposure. Using deeper deposits, the BOD_5 transferred to the overlying water decreased twentyfold after 10 days exposure to a value of about 0.4 gms BOD_5/m^2/day.

3. The breakpoint at which depth no longer influences the oxygen demand of a cellulosic deposit is no greater than 1.0 feet and may be significantly less. Studies of sludge depths of 1, 2, 3 and 4 feet (0.305, 0.61, 0.915 and 1.22 m) showed constant oxygen demands.

4. The oxygen demand exerted directly by the deposit decreases with time. The demand exerted by shallow cellulosic deposits under near stagnant conditions was found to be 0.18-0.38 gms O_2/m^2/day after 30-50 days of exposure. Velocities approaching scouring caused a demand of 2-3 gms O_2/m^2/day after compaction had essentially ceased.

5. Covering cellulosic deposits with an inert sand layer significantly lowered the oxygen uptake of the deposit after compaction was complete.

6. Mixing or turbulence increases the oxygen demand of cellulosic benthal deposit. Stagnant flow conditions produce oxygen demands of 0.2-0.8 O_2/m^2/day from shallow and deep deposits. Mixing or eddying which approaches scouring conditions increases the demand to 2.7 gms O_2/m^2/day and slight scouring caused demands of 4.4 gms O_2/m^2/day.

7. Removal of the established sludge surfaces, exposing underlying sludge, results in an equilibrium oxygen demand identical to that exhibited by the original surface.

VIII. BIBLIOGRAPHY

1. Baity, H.G., "Some Factors Affecting the Aerobic Decomposition of Sewage Sludge Deposits", Sew. Works Jour., 10, (3) 539 (1938).
2. Phelps, E.B., U.S. Geol. Survey Water Supply Paper, 229, 74 (1909).
3. Fair, G.M., Moore, E.W., and Thomas, H.A., "The Natural Purification of River Muds and Pollutional Sediments", Sew. Works Jour., 13, (2) 270, (4) 756, and (6) 1209 (1941).
4. Rudolfs, W., "Stabilization of Sewage Sludge Banks", Ind. Eng. Chem., 30, 337 (1938).
5. Bloodgood, D.E., "The Oxygen Demand of Strawboard Sludge Deposits", National Council for Stream Improvement Technical Bulletin No. 99, (October 1956).
6. Mohlmann, F.W., Herrick, T.L. and Swope, H.G., "Technic of Stream Pollution Investigations", Ind. Eng. Chem., 23, 209 (1931).
7. Knowles, G., Edwards, R.W. and Briggs, R., "Polarographic Measurement of the Rate of Respiration of Natural Sediments", Limn. Oceanog. 7, 481 (October 1962).
8. Edwards, R.W., and Rolley, H.L.J., "Oxygen Consumption of River Muds", Jour. Ecol. 53, 1 (1965).
9. Downing, A.L., "The Effects of Pollution on the Oxygen Balance of Rivers", Reprint No. 517, Water Pollution Research Laboratory, Stevenage, England (1967).
10. Lardieri, N.J., "The Aerobic and Benthal Oxygen Demand of Paper Mill Waste Deposits", Tappi, 37, 705 (1954).
11. Stein, J.E. and Dennison, J.G., "In Situ Benthal Oxygen Demand of Cellulosic Fibres", Proc. 3rd Int. Conf. on Water Poll., Water Poll. Control Fed., Washington, D.C., vol. 3, 181 (1967).
12. Hanes, N.B. and Davison, R.I., "Effect of Depth on Oxygen Uptake of a Benthal System", Proc. 23rd Ind. Waste Conf. Purdue Univ. (1968) (in press).
13. Oldaker, W.H., Burgum, A.A. and Pahren, H.R., "Report on Pollution of the Merrimack River and Certain Tributaries Part IV - Pilot Plant Study of Benthic Oxygen Demand", U.S. Dept. of the Interior, FWPCA, Northeastern Region (August 1966).

14. Hanes, N.B. and White, T.M., "Effects of Sea Water Concentration on Oxygen Uptake of a Benthal System", Jour. Water Poll. Control Fed., 40, (8) R 272 (1968).

15. "Standard Methods for the Examination of Water and Wastewater", 12th Ed. Amer. Publ Health Assn., New York (1965).

16. Hanes, N.B. and Irving, R.L., "Oxygen Uptake Rates of Benthal Systems by a New Technique", Proc. 21st Ind. Waste Conf., Purdue Univ. Ext. Serv. 121, 468 (1966).

17. McDonnell, A.J. and Hall, S.D., "Effect of Environmental Factors on Benthal Oxygen Uptake", Proc. 22nd Ind. Waste Conf., Purdue Univ. (in press).

18. McKeown, J.J., Brown, L.L. and Gove, G.W., "Comparative Studies of Dissolved Oxygen Analysis Methods", Jour. Water Poll. Control Fed., 39, (8) 1323 (1967).

APPENDIX

TABLE I.—The Effect of Sludge pH on Benthal Oxygen Demand of Shallow Deposits

Trial	Surface Area (sq cm)	pH			Additive	Peak Uptake Rate (g/day/sq m)
		Initial	Final			
			Top	Bottom		
1	190	7.2	7.4	7.1	NaOH,$CaCO_3$	0.63
		7.1	6.2	5.6	NaOH	0.25
		4.8	6.1	5.4	None	0.21
	380	7.2	6.9	6.9	NaOH,$CaCO_3$	0.53
		7.1	6.3	5.6	NaOH	0.19
		4.8	6.3	5.6	None	0.21
2	190	7.4	6.9		NaOH,$CaCO_3$	1.31
		6.3	5.7	5.0	None	0.60
	380	7.4	7.1	6.8	NaOH,$CaCO_3$	1.08
		6.3	5.8	5.2	None	0.44

Notes: 1. Trial 1 lasted 90 days.
2. Trial 2 lasted 42 days.

TABLE II.—Five-Day BOD Released from Deposits
(Values reported in mg/1.)

Sludge Ht. (ft)	4	3	1	4	3	2	1
Time (days)				b	b	b	b
1	9.1	8.0	8.5	—	—	—	—
2	9.1	4.8	5.8	10.2	17.8	19.7	14.0
3	2.1	1.1	2.0	4.8	6.9	3.0	4.8
4	1.4	0.8	2.8	2.7	1.4	1.0	1.4
5	1.4	0.8	1.1	1.3	1.0	0.4	1.1
6	0.5	0.7	0.5	1.5	0.7	0.7	0.6
7	0.8	0.7	1.1	0.4	0.5	0.7	0.4
10	0.6	0.5	0.6	0.6	1.3	0.9	1.2

Notes: 1. Each column contains a surface area of 153 sq cm and a depth of water of at least 61 cm.
2. Thus, at least 9.3 l of water contain the BOD concentration noted.
3. Contribution after 10 days of 0.6 mg/l = 5.6 mg O_2/day as BOD or 0.37 g/day/sq m.
4. b indicates a buffered deposit.
Ft × 0.3 = m.

TABLE III. Summary Data on Sludge Depth Study

Depth (ft)	pH			(Oxygen Uptake Rate (mg/day)		
	Initial	Final		No Mixing	Normal Mixing	Slight Scour
		Top	Mid-Depth			
4	4.1	5.2	4.8	17	38	67
3	4.1	5.2	4.9	10	41	68
2	4.1	5.0	4.9	11	42	58
1	4.1	5.0	—	10	40	66
4 b	6.5	5.3	6.7	14	32	55
3 b	6.5	5.9	6.3	15	36	74
2 b	6.5	6.4	6.4	11	41	47
1 b	6.5	5.5	6.1	13	45	67

b indicates a buffered sludge.
Note: Ft × 0.3 = m.

TABLE IV. Initial and Long-Term Oxygen Demand of Shallow Deposits

Sludge	Peak Demand		Long-Term	
	g/day/sq m	lb/day/acre	g/day/sq m	lb/day/acre
Fresh	1.23	11.0	0.29	2.6
	1.12	10.0	0.19	1.7
	0.92	8.2	0.18	1.6
Aged	0.46	4.1	0.27	2.4
	0.48	4.3	0.19	1.7
	0.53	4.7	0.24	2.1
	0.53	4.7	0.38	3.4
	0.40	3.6	0.30	2.7

Note: lb/day/acre × 1.12 = kg/day/ha.

NOTE:

Tables 1 through 7 have been reproduced, with permission, from the August 1968 Journal Water Pollution Control Federation (Vol 40, No 8, Part 2).

TABLE VI.—Final Analysis of Sludge in Depth Study

Depth		Age (days)	Conditions	Surface				Middle				Bottom			
Initial (ft)	Final (ft)			TS (%)	TVS (%)	pH	BOD_5 (mg/l)	TS (%)	TVS (%)	pH	BOD_5 (mg/l)	TS (%)	TVS (%)	pH	BOD_5 (mg/l
4	3.6	61	(U)	3.14	2.36	5.2	135	4.00	3.15	4.8	283	4.01	3.08	4.8	523
3	2.0	61	Dredged (U)	3.91	2.68	5.2	125	3.89	2.98	4.9	333	4.05	3.14	4.8	402
2	1.5	52	Sanded (U)	9.94	4.60	5.0	281	4.68	3.58	4.9	408	4.51	3.49	5.0	329
1	0.9	61	(U)	4.85	3.70	5.0	183	—	—	—	—	—	—	—	—
4	3.7	60	(b)	2.96	2.22	5.3	95	4.12	3.00	6.7	191	4.02	3.11	6.5	381
3	2.0	6C	Dredged (b)	3.70	2.79	5.9	1,140	4.38	3.33	6.3	796	4.09	3.15	6.4	975
2	0.9	60	Sanded (b)	10.7	6.16	6.4	916	7.24	5.44	5.4	825	6.62	5.09	6.3	720
1	0.9	60	(b)	2.38	1.75	5.5	249	3.63	2.78	6.1	1,140	4.41	3.45	6.3	1,230
—	—	0		3.67	3.05	4.1	117								

U indicates an unbuffered sludge.
b indicates a buffered sludge.
Ft × 0.3 = m.

TABLE VII.—Summary of Various Investigations on Benthal Deposit Depth

Author	Depth (cm)	Area (sq cm)	Vol Solids (g)	Areal conc (kg/sq m)	Oxygen Uptake		
					(mg/day)	(g/day/sq m)	(mg/day/gvs)
1	0.1	540	3.8	0.07	30	0.55	7.9
	0.5	540	19	0.35	101	1.87	5.3
	1.0	540	38	0.70	156	2.89	4.1
	1.5	540	57	1.06	187	3.47	3.3
	2.0	540	76	1.41	204	3.78	2.7
	4.0	540	152	2.82	280	5.19	1.8
3	10.2	526	193	3.77	245	4.65	1.24
	4.7	526	73	1.38	162	3.09	2.22
	2.5	526	27	0.51	89	1.70	3.29
	1.4	526	9	0.18	57	1.08	6.0
	1.4	526	9	0.19	54	1.02	5.7
10	3.8	20.2	3.1	1.53	4.4	2.20	1.44
	8.1	20.2	6.2	3.07	4.5	2.25	0.73
	16.0	20.2	12.4	6.14	6.0	3.00	0.49
THIS STUDY	30.5	153	130	8.5	40	2.7	0.31
	61.0	153	261	17.1	40	2.7	0.15
	91.5	153	391	25.6	40	2.7	0.10
	122.0	153	522	34.2	40	2.7	0.08
8	4–17	—	—	—	—	2.0	—
	4–17	—	—	—	—	4.8	—
11	—	—	—	—	—	4.9–5.9	—
Lab Field	—	—	—	—	—	3.6	—
12	1.6	139.5	5	0.34	21.8	1.56	4.35
	14.6	139.5	51	3.65	20.1	1.44	0.39
	29.3	139.5	102	7.32	22.4	1.61	0.22
13	1.5	596	33.2	0.56	49.2	0.82	1.48
	10	596	168	2.82	46.1	0.77	0.27
	15	596	251	4.21	59.0	0.97	0.23
	20	596	336	5.64	59.6	1.00	0.18
17	2					3.41	
	5					4.80	
	12					4.56	
	25					6.17	

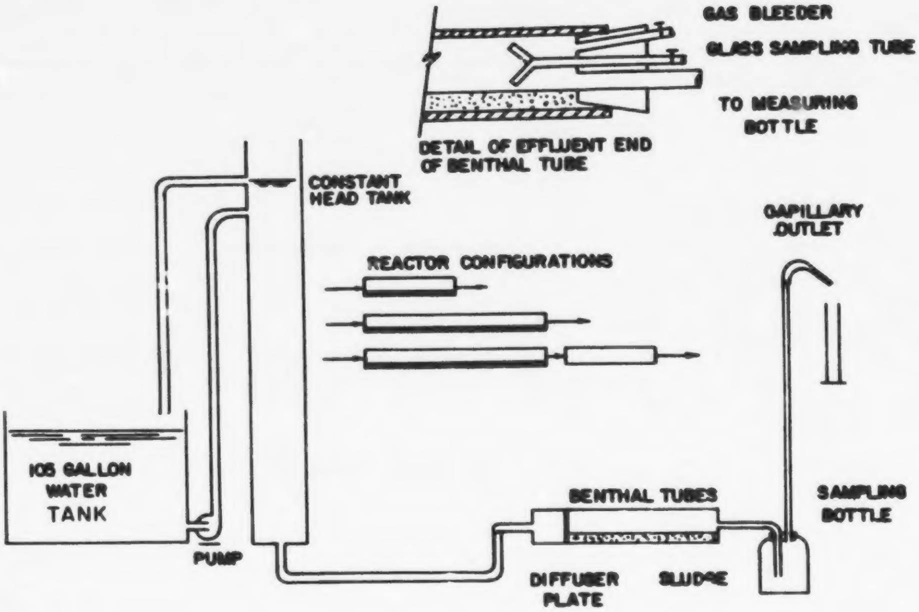

GAS BLEEDER
GLASS SAMPLING TUBE
TO MEASURING BOTTLE
DETAIL OF EFFLUENT END OF BENTHAL TUBE
CONSTANT HEAD TANK
CAPILLARY OUTLET
REACTOR CONFIGURATIONS
105 GALLON WATER TANK
PUMP
BENTHAL TUBES
SAMPLING BOTTLE
DIFFUSER PLATE
SLUDGE

FIGURE 1
HORIZONTAL TUBE ASSEMBLY FOR BENTHAL DEPOSIT STUDIES

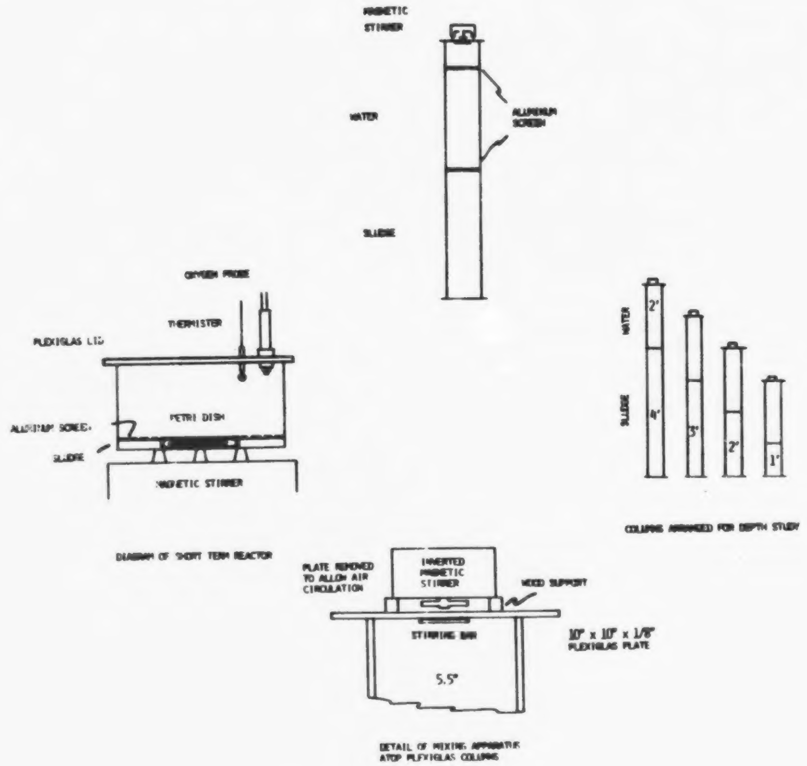

MAGNETIC STIRRER
WATER
ALUMINUM SCREEN
SLUDGE
OXYGEN PROBE
THERMISTER
PLEXIGLAS LID
PETRI DISH
ALUMINUM SCREEN
SLUDGE
MAGNETIC STIRRER
WATER
SLUDGE
2'
4'
3'
2'
1'
PLATE REMOVED TO ALLOW AIR CIRCULATION
INVERTED MAGNETIC STIRRER
WOOD SUPPORT
STIRRING BAR
10" x 10" x 1/8" PLEXIGLAS PLATE
5.5"

DIAGRAM OF SHORT TERM REACTOR

COLUMNS ARRANGED FOR DEPTH STUDY

DETAIL OF MIXING APPARATUS ATOP PLEXIGLAS COLUMNS

FIGURE 2 - VERTICAL TUBE ASSEMBLIES

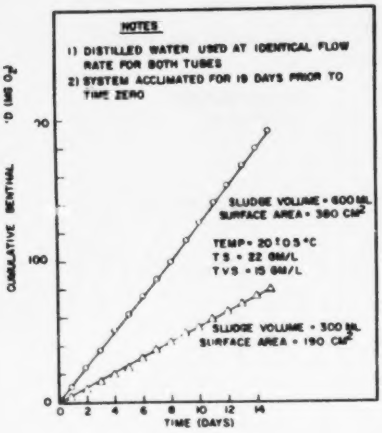


FIGURE 3

THE EFFECT OF SURFACE AREA ON OXYGEN UPTAKE OF BENTHAL DEPOSITS IN A CONTINUOUSLY FLOWING SYSTEM

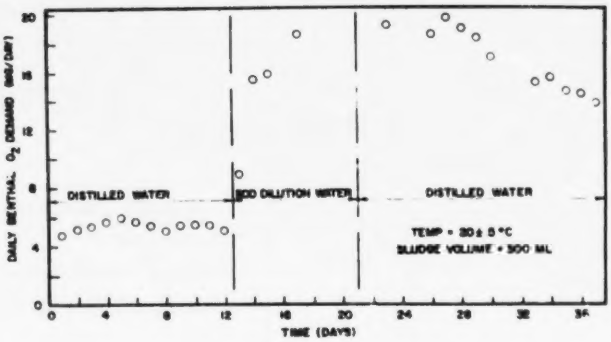


FIGURE 4

DAILY BENTHAL DEMAND UNDER VARYING TEST CONDITIONS

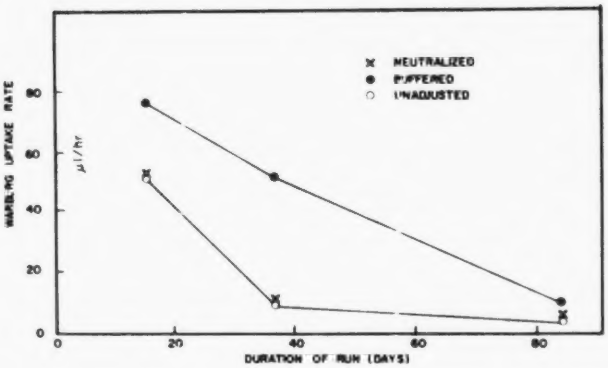


FIGURE 5

UPTAKE RATE OF SLUDGE SAMPLES PERIODICALLY REMOVED FROM TUBES USING THE WARBURG RESPIROMETER

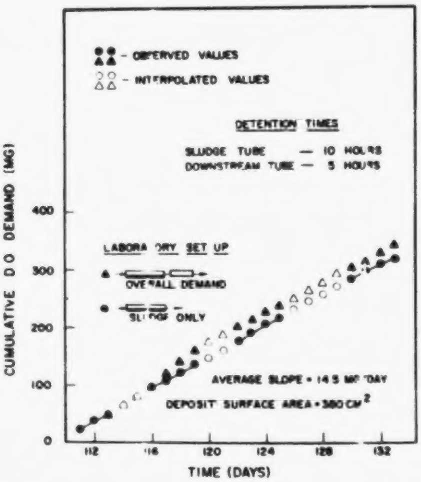


FIGURE 6

OXYGEN DEMAND DOWNSTREAM FROM A DEPOSIT

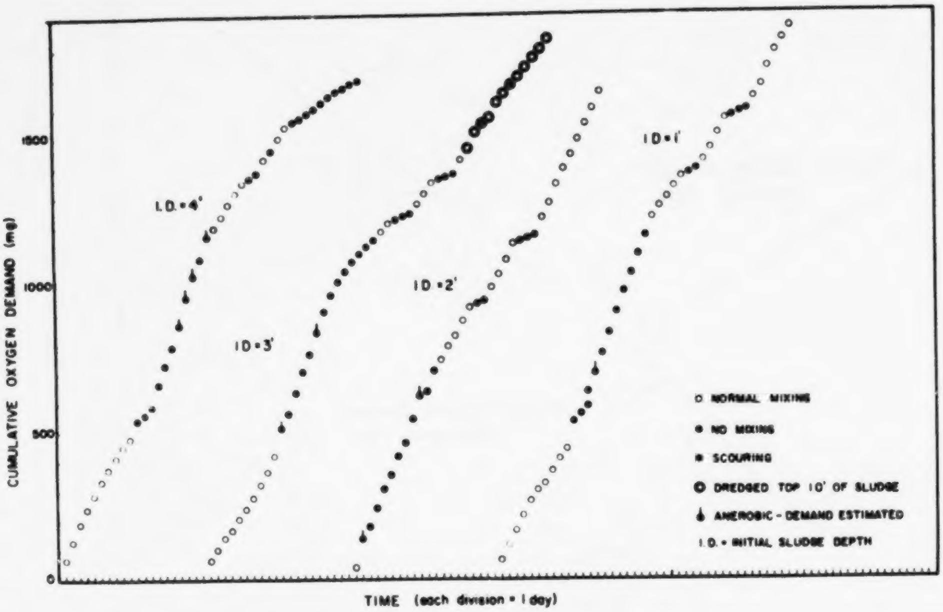


FIGURE 7a - OXYGEN DEMAND OF UNBUFFERED SLUDGE DURING DEPTH STUDY

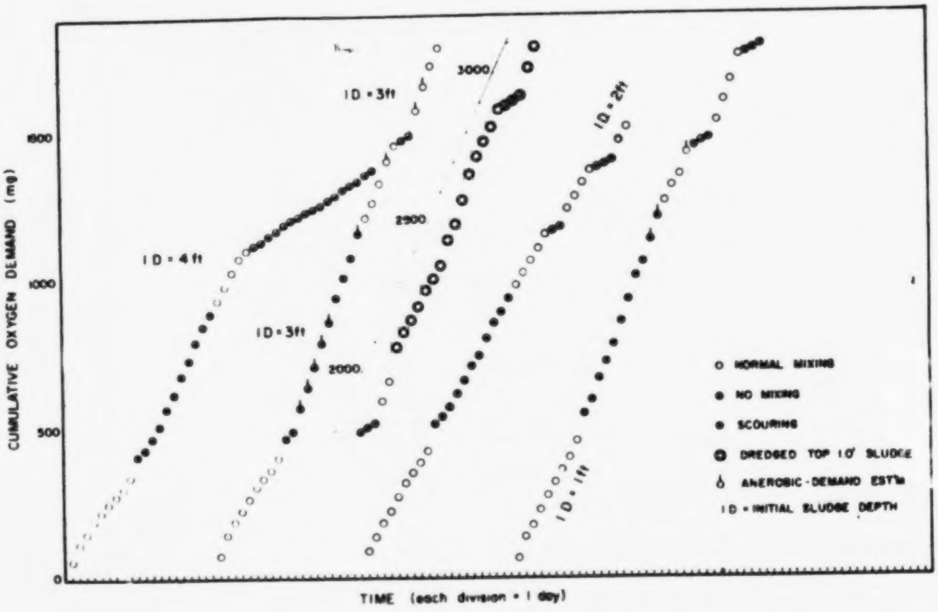


FIGURE 7b - OXYGEN DEMAND OF BUFFERED SLUDGE DURING DEPTH STUDY

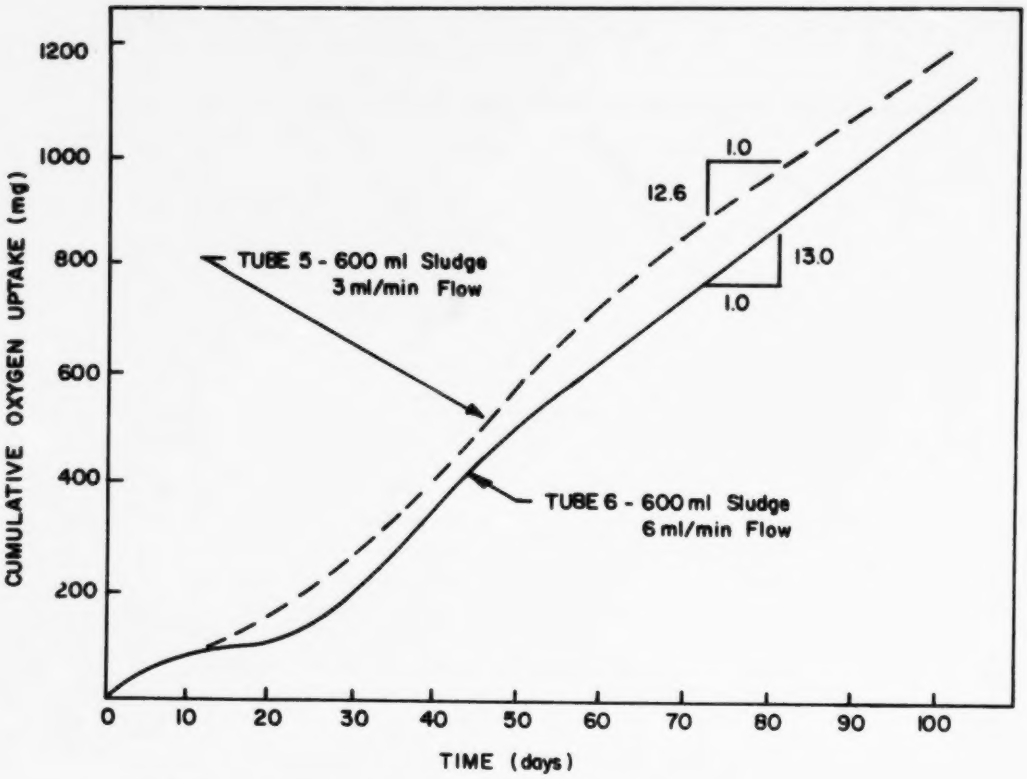


FIGURE 8 - EFFECT OF FLOW ON BENTHAL DEMAND OVER SLUDGE

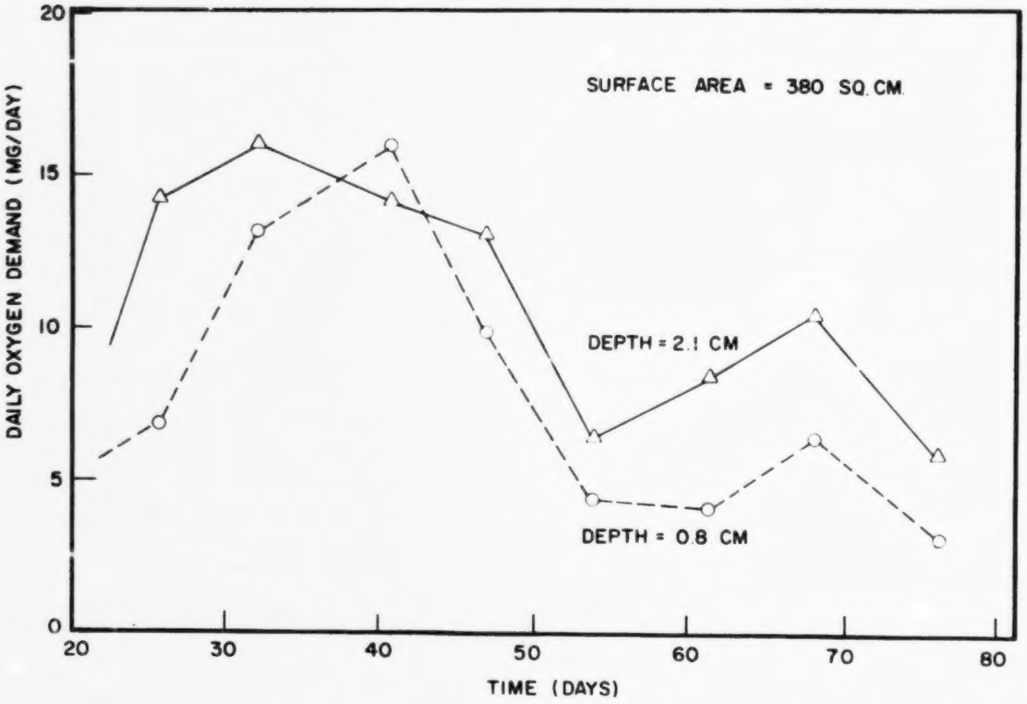


FIGURE 9 DAILY OXYGEN DEMAND OF AN AGING PAPER MILL DEPOSIT

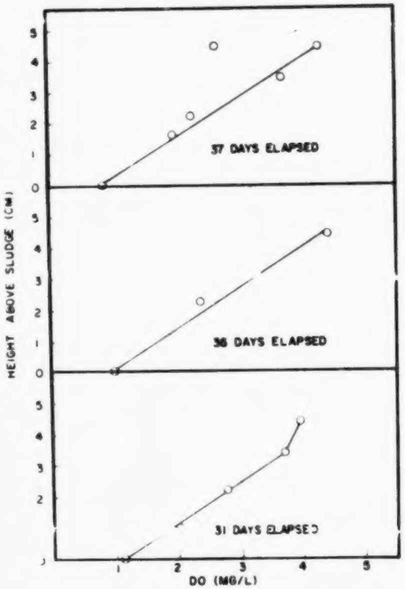
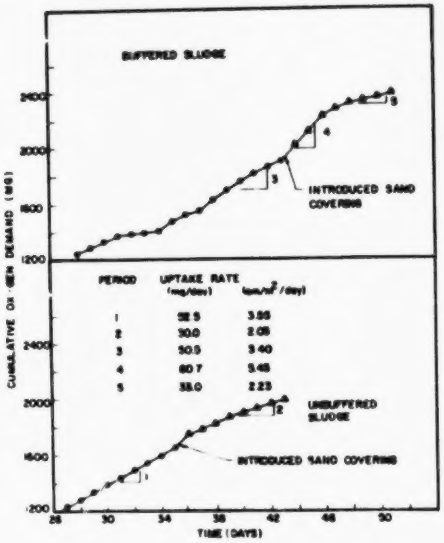


FIGURE 10 VERTICAL OXYGEN GRADIENT OVERLYING SLUDGE NEAR EXIT OF CONTINUOUS FLOW TUBES



PERIOD	UPTAKE RATE (mg/day)	(gm/m²/day)
1	52.5	3.33
2	30.0	2.05
3	50.5	3.40
4	80.7	5.45
5	33.0	2.23

FIGURE 11

THE EFFECT OF A SAND COVERING ON AN AGING SLUDGE DEPOSIT

Reproduced from
best available copy.

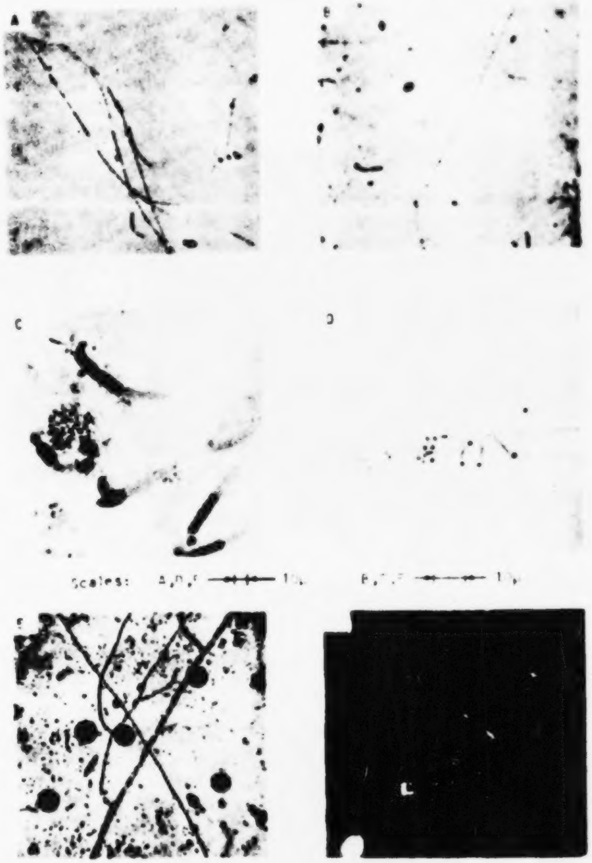
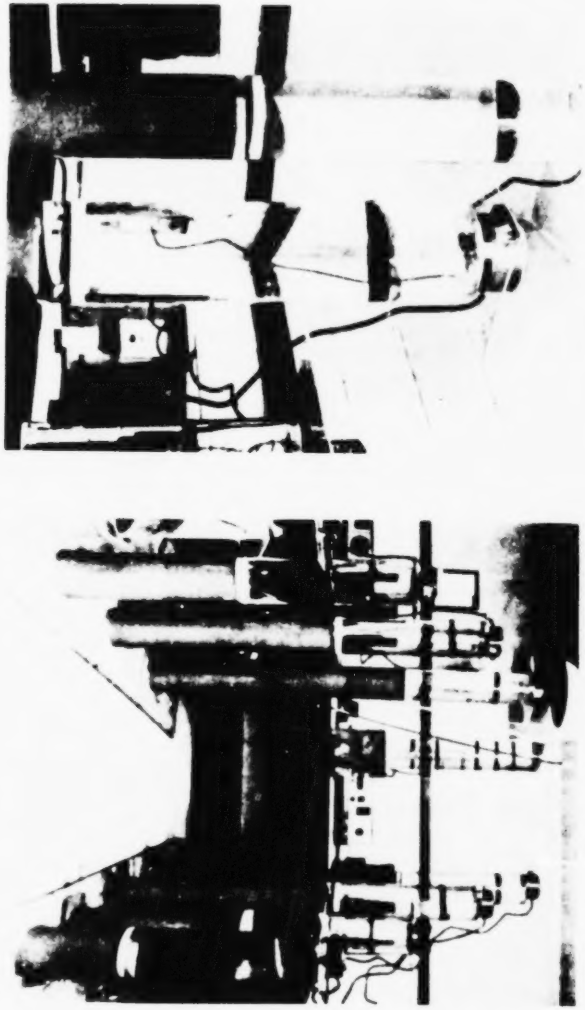
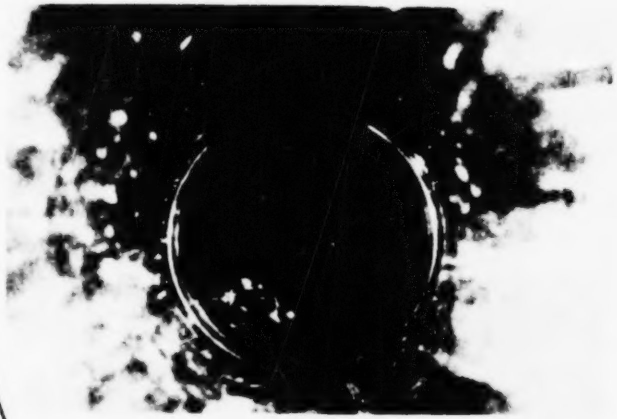


FIGURE 12 TYPICAL SLIME ORGANISMS FROM BENTHAL TUBES



Reproduced from best available copy.



TOP VIEW OF SURFACE

SIDE VIEW OF SURFACE

PHOTOGRAPHS OF VERTICAL TUBE BENTHAL REACTORS

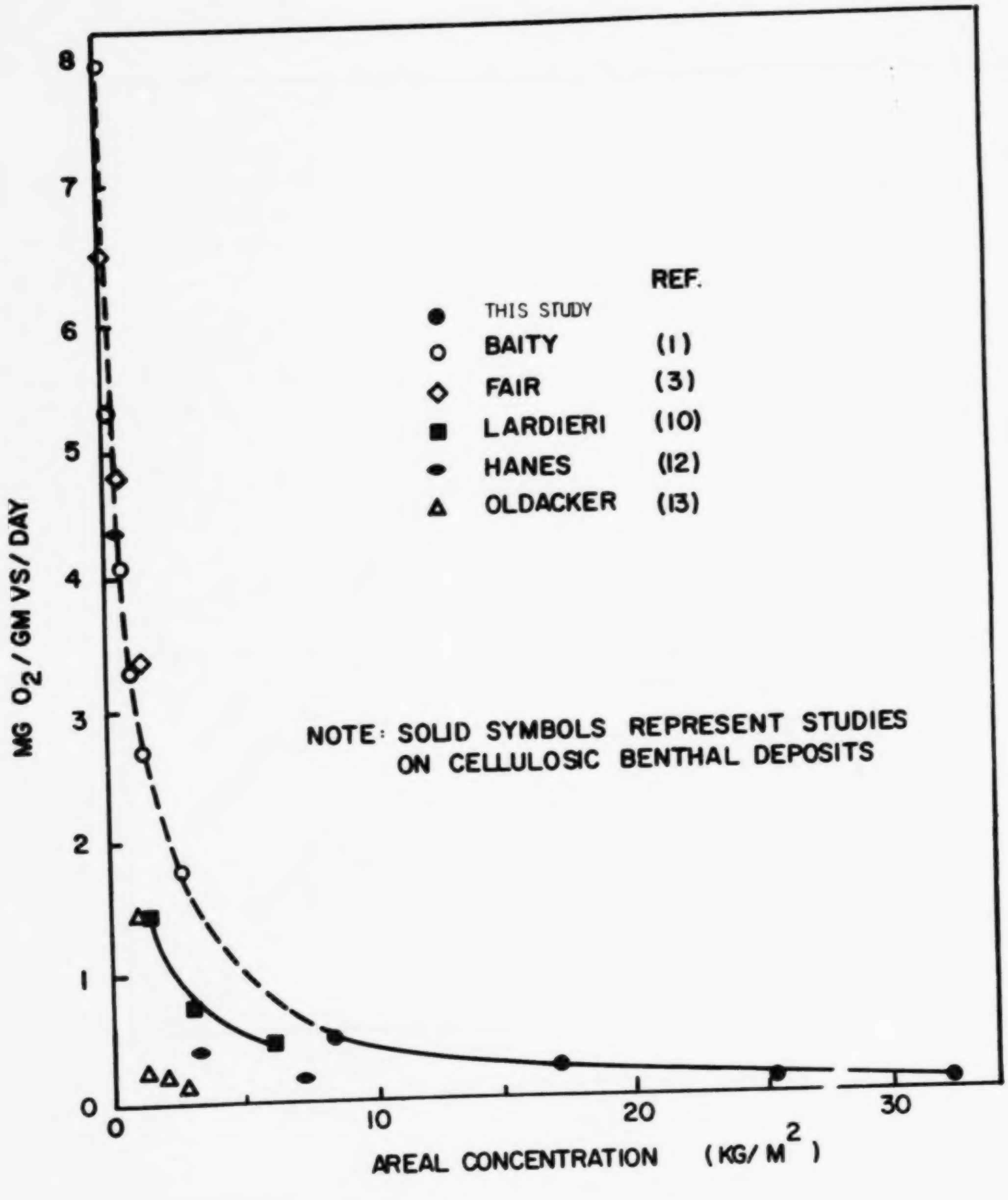


FIGURE 14 - OXYGEN UPTAKE OF BENTHAL DEPOSIT AS A FUNCTION OF AREAL CONCENTRATION OF VOLATILE SOLIDS

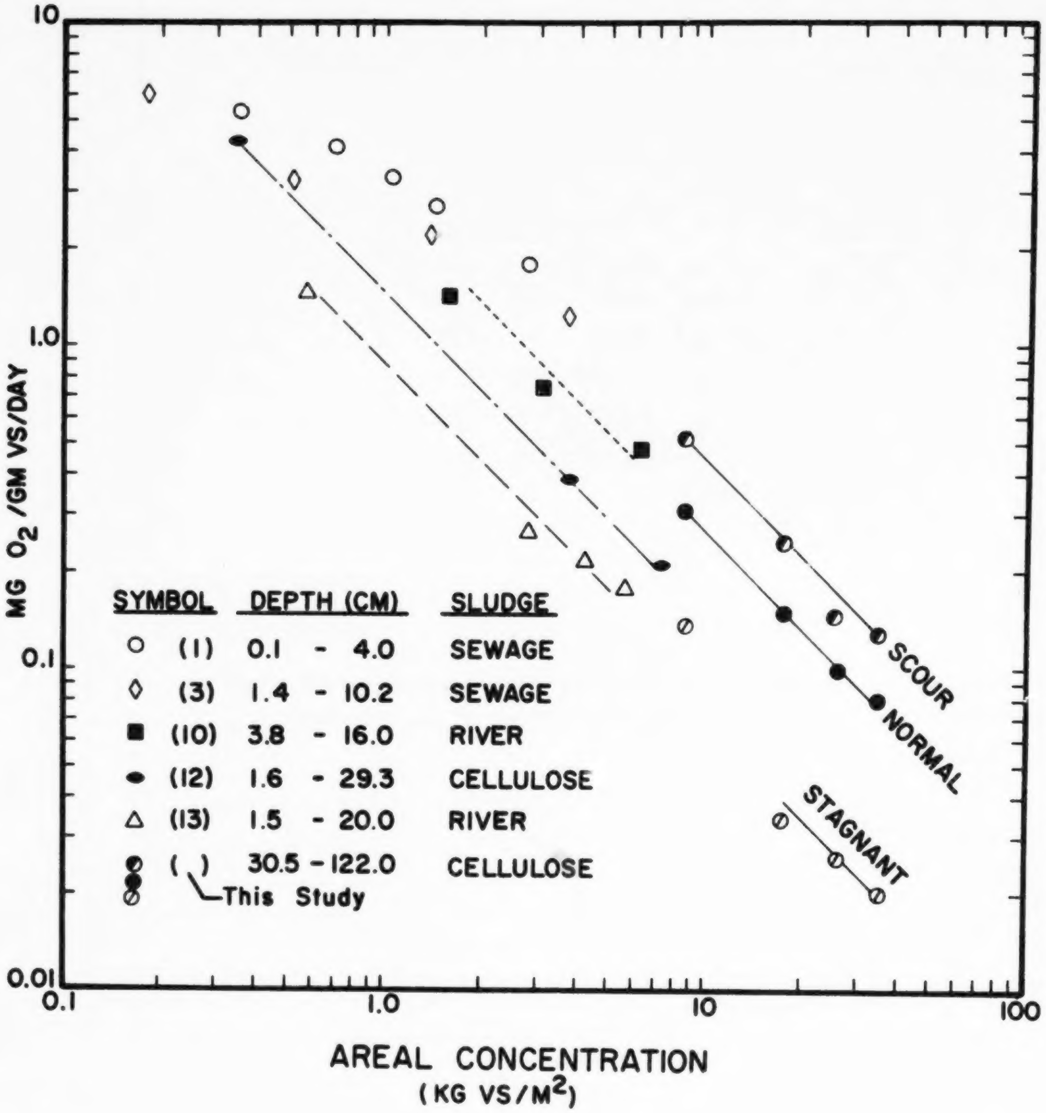


FIGURE 15 — COMPARISON OF OXYGEN DEMAND OF VARIOUS BENTHAL DEPOSITS

MR. McKEOWN: This study or portions of it have also been reported in the August 1968 research supplement of the Journal of the Water Pollution Control Federation, Washington, D. C., pages 333 to 353.

The work was performed under my direction by Dr. A. H. Benedict and Mr. G. M. Locke who at the time was a candidate for a Master's degree in environmental engineering at the university. All work reported was performed between 1964 and 1967 at Tufts University in Medford.

I would like to briefly describe the study.

MR. STEIN: By the way, these photographs aren't going to make it.

MR. McKEOWN: We will see what we can do about it.

MR. STEIN: As a matter of fact, unless we can improve these, it would be just as well to leave them out.

MR. McKEOWN: Let me see if I can get you the originals.

First, the study was a complete laboratory investigation. It utilized laboratory reactors which contained especially prepared sludge deposits of wood origin which were subjected to various conditions of flow and mixing in the overlying water.

The study was almost exclusively concerned with the determination of the oxygen demand related to the laboratory deposits.

The report describes the laboratory systems used, the preparation of the benthal deposits and the experimental conditions of the various tests performed.

The following factors were examined as related to the oxygen demand of the deposits:

A. Deposit surface area.

B. pH of the deposit.

C. Downstream transfer of soluble BOD.

D. Deposit depth.

E. Mixing conditions above the deposit.

F. Preliminary aging of the sludge.

G. Overlying water dissolved oxygen concentration.

H. The addition of inert sediments and cover.

I. Dredging of the top layer.

Furthermore, the study reviewed the work reported by previous investigators and compared results on three counts.

The first of these, a lot of people have done a lot of work on depth of deposits and the effect of the depth on the oxygen demand in the overlying water.

The synopsis of this review and of our own studies indicate studies of age deposits undergoing stabilization and where additional deposition is no longer taking place indicate that oxygen demand is independent of the sludge depth.

The second area that a number of people have looked at is the volatile solids and the amount of organic material present in the sludge deposit as a whole.

In general, the results fall in line with organic content, more organic content, in the sludge the higher the demand in the overlying water immediately adjacent to that sludge.

The last area is that of the amount of surface presented by the deposit to the overlying water.

The data exhibited in this report show that regardless of type, age and origin of sludge used in the various studies reported that the maximum oxygen uptake is generally less than 6 grams per square meter per day.

Further deposits which are believed to have reached equilibrium with respect to sludge compression and contain at least 50 percent volatile matter show an oxygen uptake in the range of 1.5 to 5 grams of oxygen per square meter per day.

Long-term studies conducted using cellulosic deposits indicate oxygen demand to be in the order of 2 to 3 grams of oxygen per square meter per day of flow conditions approaching scouring.

Let me cite for you the 7 conclusions of the report, and that will end my testimony here at this point.

Conclusions: Laboratory studies have been conducted on the oxygen demand exerted by cellulosic benthal deposits. The conditions imposed upon the study were such that the deposit was initially homogeneous, continuous deposition had ceased, the overlying water contained dissolved oxygen, temperature of the system was constant, and mixing was controlled. The following conclusions are presented:

1. Uptake of oxygen by benthal deposits is directly proportional to surface area of the deposit and this rationale is believed to be most applicable to deposits of cellulose origin.

2. The BOD_5 transferred to the overlying water decreases with time and in the case of shallow deposits was essentially zero after 100 days exposure. Using deeper deposits, the BOD_5 transferred to the overlying water decreased twentyfold after 10 days exposure to a value of about 0.4 gms BOD_5/m^2/day.

3. The breakpoint at which depth no longer influences the oxygen demand of a cellulosic deposit is no greater than 1.0 feet and may be significantly less. Studies of sludge depths of 1, 2, 3 and 4 feet (0.305, 0.61, 0.915 and 1.22 m) showed constant oxygen demands.

4. The oxygen demand exerted directly by the

deposit decreases with time. The demand exerted by shallow cellulosic deposits under near stagnant conditions was found to be 0.18 - 0.38 gms $0_2/m^2$/day after 30 - 50 days of exposure. Velocities approaching scouring caused a demand of 2-3 gms $0_2/m^2$/day after compaction had essentially ceased.

5. Covering cellulosic deposits with an inert sand layer significantly lowered the oxygen uptake of the deposit after compaction was complete.

6. Mixing or turbulence increases the oxygen demand of cellulosic benthal deposit. Stagnant flow conditions produce oxygen demands of 0.2 - 0.8 gms $0_2/m^2$/day from shallow and deep deposits. Mixing or eddying which approaches scouring conditions increases the demand to 2.7 gms $0_2/m^2$/day and slight scouring caused demands of 4.4 gms $0_2/m^2$/day.

7. Removal of the established sludge surfaces, exposing underlying sludge, results in an equilibrium oxygen demand identical to that exhibited by the original surface.

These are the conclusions of the laboratory investigation as I described it.

MR. STEIN: Thank you, Mr. McKeown.

Any comments?

MR. PAHREN: On your last conclusion, Jim, this from the standpoint of the Lake Champlain sludge would mean if any of the sludge is transferred from the bottom to the top due to the exigencies of decomposition, the new exposed area would start the process all over again, right?

MR. McKEOWN: As we found from the laboratory study, by taking the top material which had fairly well stabilized, removing it and leaving what was underneath, we returned to the original rate of oxygen demand of the material in the laboratory study.

MR. PAHREN: So you would have perhaps additional material doing the same thing, creating additional oxygen, the new material that is uncovered because the top material starts floating away.

MR. McKEOWN: Again, Mr. Pahren, in this study, that is what we saw in the laboratory.

MR. PAHREN: In your figure 7, accumulative oxygen demand versus time, I note that after quite a few days, they are not marked, but whether they are 50 or 70 or 80, I am not sure.

MR. McKEOWN: Each division is a day.

MR. PAHREN: There are no numbers to guide me is what I am talking about. The slope does not taper off during the end of your test period indicating that the oxygen demand is still going strong when you cut off your study, is that correct?

MR. McKEOWN: The slopes as evidenced here are the result of varying tests performed on each column, these columns now being 6 foot tall in a larger sense, 4 foot of sludge in the bottom of the column and 2 foot of water overlying the sludge material with the overlying water being stirred at a constant rate. We then subjected these deposits to varying stresses, some of them being putting fill on top of them, some of them dredging them, some of them leaving them exposed to some anaerobic conditions for a time and things of this sort. This was the pack study, the flow-through study. Accomplishing this showed the decrease with the oxygen demand with age as reported in one of the earlier conclusions.

MR. PAHREN: So this just indicates that the problem does not cease the day that the discharge ceases from the mill. It continues for a period of time.

MR. McKEOWN: There was no problem in the laboratory studies. I have difficulty in relating this to your question.

MR. PAHREN: Well, even in the laboratory, the oxygen demand continued well after day one when you put the material in place.

MR. McKEOWN: Yes. We had oxygen demand throughout the study.

MR. PAHREN: O.K.

MR. STEIN: Mr. Miller.

MR. MILLER: Mr. McKeown, I presume this study is presented as a laboratory study which will inform us with respect to the particular condition that we are considering on Lake Champlain.

MR. McKEOWN: The study is presented because in the laboratory we could control things and observe other things, whereas this is not always the case elsewhere. It is simply presented as a laboratory study dealing with sludges as specified and as I have presented it, yes, sir.

MR. MILLER: As a layman, could we perhaps try to distinguish certain differences between what a very quick survey of this study tells me as compared to what we have in the lake? And on that, I would like your expert opinion.

In the laboratory studies, did you make any tests that would simulate or correspond to the conditions that we have during the warmer months of the year in a comparatively deep deposit? The maximum depth, I believe the record shows, is 12 feet tapering off in a cone. Did you simulate any such warming conditions and their effect upon what is called benthal deposits in the laboratory?

MR. McKEOWN: I did not.

MR. MILLER: Well, in this case, we are essentially dealing, not only with water quality, but we are dealing with what has been characterized, and I certainly feel the same way about it, as material that is in the nature of a public nuisance. This material, whether you tested it or not, from our experience during the summer months is heated or acted upon by some force, the sunlight or something. The volatile matter is activated. It gasifies, smells of hydrogen sulfide which is pretty close to rotten eggs, I guess, but is even worse, rises to the surface, frees itself and under the prevailing wind comes over on our shore. Is there anything in that test that can inform us as to those conditions?

MR. McKEOWN: In the laboratory investigation, we had one condition which indicates that we had dissolved oxygen present overlying the deposit at all times. Sludge deposition had ceased. There wasn't any in this. We were dealing with a firm surface. In this study, we kept the temperature constant so that we could eliminate that variable from affecting the study.

With regard to gas production in the study, there were times of some gas production that we observed. And these are noted in the report when you get into reading it. These are things that we did observe in the study and which I have reported on. I cannot comment on your situation here. I am not knowledgeable of your situation except from what I have heard today.

MR. MILLER: Well, perhaps you might wish to accept some of these facts which are well documented in this record and, if you wish, to give us your opinion on them because they are crucial to Vermont's case in this matter. And I recognize that the paper industry has a great stake in this. But I should think that this condition would be of interest, not only to the industry, but to you good gentlemen who are doing research for them.

Now, conclusion 7 seems to indicate that if a layer of this material is removed, if I understand the conclusion correctly, the whole oxygen demand cycle then returns to its highest level. Is that correct?

MR. McKEOWN: That is what we found in the situation, yes, sir.

MR. MILLER: Good. If the record in this case and the testimony in this case is correct and if during the warmer summer months substantial amounts of these benthal deposits are activated and float and remove themselves from the deposits, would you consider that then the sludge from which this has been removed would become active in their demands for oxygen from the waters above them?

MR. McKEOWN: What we did here was take 3 foot of sludge, remove the top foot after we had stabilized to a point, and we saw a return to the original higher demand we had earlier. This is what the laboratory test says.

MR. MILLER: Mr. Chairman, this gentleman has come before us with a paper from the paper industry. I am asking if he has any opinion and if he cares to give it to us. We know what the paper says. I request he either give us his expert opinion in this matter or he doesn't choose to.

MR. McKEOWN: You have the results of what I am prepared to present.

MR. STEIN: In other words, your expert opinion is reserved to your laboratory tests, and you don't care to venture one as to the situation in Lake Champlain in the vicinity of Ticonderoga?

MR. McKEOWN: No, sir.

MR. MILLER: In that event, I can only conclude that this paper, whatever relevance it has to our situation, no more,no less.

MR. STEIN: That's all right. I take that as fair.

Are there any further questions?

MR. ALBERT: I had a question.

I think, Jim, looking at this paper very quickly, what you are saying is if the interface is not disturbed, you get rather rapid stabilization and reduction in oxygen. If the interface is disturbed, then you repeat the cycle again.

MR. McKEOWN: That is correct. The term "rapid" is open to question.

MR. ALBERT: I don't mean rapid. The point is if the interface is not disturbed, you get stabilization.

MR. McKEOWN: That is correct.

MR. ALBERT: And if the interface,by wave action or any other mechanical movement is disturbed you repeat the cycle again.

MR. McKEOWN: This indicates that.

MR. PELOQUIN: Jim, in the preparation of your benthal deposit, I get the impression this was strictly a pulp paperworks, there were no outside ingredients?

MR. McKEOWN: Yes, there were outside ingredients, but they were to simulate what a river -- in other words, BOD dilution water in the space between the fibrous and --

MR. PELOQUIN: There were no other organic materials that would be associated with sewage which you most likely would find in a sludge deposit?

MR. McKEOWN: No. Some of the material was seeded with sewage in order to give it a biological content. But we did not seed it with large amounts of material containing BOD as related to sewage.

MR. PELOQUIN: Do you feel that a substantial sewage contribution of mix with sludge would have a synergistic effect in giving you different results insofar as continued oxygen?

MR. McKEOWN: We studied the condition where we had a very small amount of sewage involved with the sludge, strictly a seed amount. That is the only thing we did study. And that is the only thing I am prepared to report on.

MR. STEIN: Thank you.

Are there any other comments or questions?

(No response.)

You know, I don't want to belabor this, but let me put this out. You indicate that it probably would be better to cover something with an inert sand layer than to disturb it.

MR. McKEOWN: In your effects.

MR. STEIN: Don't you want to relate that? I am referring to 5 and 6.

MR. McKEOWN: I think if you read 5, 6 and 7, that is basically what the study says.

MR. STEIN: Well, if you did an inert sand layer, supposing the industry were totally responsible, if you made a rough translation, that would cost the industry $70,000 more. And I think this is a landmark study, because it is great when we have four alternatives and one of the National Council studies can come up with one of the alternatives that is going to cost the pulp and paper industry more than the others. I think we may have gotten something.

The other thing, you say you can handle this in a laboratory to do this study because you control the factors that you can't do outside. Is that the basis of this?

MR. McKEOWN: No, no. The basis of the laboratory study versus something in the field is that we have better control over our conditions.

MR. STEIN: And outside you can't always control the condition.

MR. McKEOWN: That's right. Something may vary you don't have control over and would affect your results so you cannot properly interpret them.

MR. STEIN: And in one of your conclusions, you say, "continuous deposition had ceased."

Now, what Vermont has said or possibly New York, "The trouble is in the field, we haven't been able to get International Paper to discontinue its continuous deposition." And this is what the burden of the complaint is.

Now, if this is in essence a part of the assumption that your conclusions are based on, I don't wonder that Vermont is complaining about hot weather stuff boiling up, coming over to the Vermont side, creating a nuisance, zero degree oxygen, close to zero, in other portions. And I am not sure in the laboratory unless we simulate those conditions that Vermont is going to be very impressed.

Now, as I say, I just glanced at this, and I think the study and the formulas look like a well-developed study. But I do think that Mr. Miller's comments are pertinent. The question is: How does this relate to the conditions that we are dealing with here? And I think in a sense you have answered it.

Thank you very much.

MR. EASTMAN: Is there anyone else from New York State who wishes to comment?

(No response.)

If not, that is all from New York.

MR. STEIN: Let's hear from Mr. Peloquin of the Interstate Commission.

Mr. Peloquin.

STATEMENT OF
ALBERT PELOQUIN, EXECUTIVE SECRETARY
NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION
BOSTON, MASSACHUSETTS

MR. PELOQUIN: Mr. Chairman, the Commission has no formal statement prepared. And I have listened to all of the testimony. And on the basis of the initial discussions of the alternatives proposed by the Corps of Engineers, the feeling is that the removal of material would probably be the most desirable corrective measure.

However, on the basis of testimony by Mr. Hamilton, I think perhaps we should re-evaluate the site.

The question of mercury has been discussed quite thoroughly today. And I think from information furnished or available to us from several sources, I feel that we are lacking considerably in evaluating the impact of these particular constituents. And I would like to propose to the conferees that as soon as possible we develop some type of program or a study -- hopefully, we could get results within 30 days -- to determine the impact of mercury contents both from the standpoint of the bottom muds and the impact on the fish.

It seems quite clear from testimony presented that the content of mercury in water is within the safe limits. But in order to proceed expeditiously with the problem in hand of the sludge deposits, I would propose we immediately concentrate on that area and try to determine just what toxic effects might result from the sludge removed, particularly from the mercury content and I think perhaps through the use of modern technology try to zero in on other materials which could prove deleterious in removal action.

I throw this out to the conferees for consideration at this point, Mr. Chairman, to see what could be done.

MR. STEIN: Right.

Thank you, Mr. Peloquin, for a perspective statement.

Let me make one point, and this is just a small one at the beginning because I think it is a procedural one, but an important one. If we had the assumption -- and I don't make it now -- that the sludge has to be removed and you have two choices, to leave it there or remove it, if we make the assumption it has to be removed, then the question is where are you going to put it? You are not going to put it in the lake. I think we are pretty much in agreement with that. Surely Vermont isn't going to accept it. So this becomes a New York problem.

One of the things you said at the beginning, if we can get by this, maybe we can at least narrow the scope of the options. If we are talking in terms of removal, again, without saying you are going to do it and there is a question of the site, where you are going to put it, and you are going to put it in New York State, I don't think this is an evaluation that the conferees necessarily have to evaluate themselves, but this is a problem for New

York State. And if New York State agrees that this should be removed, whoever removes it and comes up with a satisfactory site that satisfies the Interstate Commission's water quality requirements and Vermont and the Federal Government, I do not think the site selection operation should be a conferee operation any more than a site selection of a sewage treatment plant or an industrial treatment plant is a judgment that should be left to the people.

Now, the reason I say this, as you can tell from the talks we had here, the statements, the site selection is going to get more difficult, is possibly going to be the most difficult procedural step. And the more cooks we have with a hand in the pot, the harder this is going to be to resolve.

But other than that, I would subscribe completely to your suggestions on what you say.

MR. MILLER: Mr. Stein, does this conclude our proceeding?

MR. STEIN: Almost.

Now, the conferees have several choices. We can have an executive session this afternoon and come out with a statement if you want to. We can have an executive session in the morning, or you can proceed in any other way to conclusions and recommendations. What is your wish?

MR. MILLER: I don't think this needs go into the record.

(Discussion off the record.)

MR. STEIN: I would think if it is convenient to you people, if this is convenient to the other conferees, we can go into executive session tonight after we recess here in about 10 minutes. Is that agreeable?

MR. MILLER: Excuse me. Mr. Hansen wanted to ask one question.

MR. HANSEN: Just before we get into that procedural matter, something has been sort of bothering me ever since it came up. Mr. Morette indicated that further tests in this area are going to uncover something which might be even more dangerous than mercury. I hate to think we are going to come back here at some other time and find we have some new thing we have to go up and test for. Would he tell me what he thinks might be found there so any tests might be for that particular element or compound or whatever it might be.

MR. STEIN: Mr. Morette, did you hear that? Do you want to answer that?

MR. MORETTE: I will tell you when you come over to test. I will tell the tester so he will be able to look for it.

MR. STEIN: Mr. Morette, may I make a suggestion? Testing for mercury or any other specific material is not the easiest thing in the world. Unless we come prepared to look for that substance, we are not going to have the techniques and the equipment lined up. So the more advanced notice we get, the better we are going to be. We have been sampling muds and the States have been sampling muds for 30 years, and we haven't found mercury. Why? Because we haven't been looking for it.

In other words, if you have an idea, tell us what you want to look for so we can be prepared to look for it. Otherwise, the chances are we are not going to find it.

All right, do you have any other thing?

MR. HANSEN: No. I just would kind of like to know that.

MR. STEIN: Well, all right. We are glad to get all the information, but in the absence of further indications, I assume we will come prepared to look for mercury.

Now, it is 4:30. How long do we have this room?

MR. HEMENWAY: As long as you want it.

MR. STEIN: I think if we fail on this, we will let you know, but I think we may be able to come out with a statement by 5:30 and possibly before that. If we cannot arrive at an agreement or we are going to have a prolonged executive session, we will send out word.

So we will stand recessed now until about 5:30 when we will reappear in this room.

(Whereupon, at 4:23 o'clock p.m., the meeting recessed, to reconvene at the end of the executive session.)

MR. STEIN: Let's reconvene. First, I am pleased to announce that the conferees have unanimously agreed on all conclusions and recommendations. Let me read them. They are very short and there are three of them.

The conferees unanimously agree that:

(1) Pollution of interstate waters, subject to abatement under Section 10 of the Federal Water Pollution Control Act as amended, occurring in Lake Champlain as the result of the discharge of untreated waste from the International Paper Company plant, shall be abated by July 1, 1970. This in accordance with the Water Quality Standards Implementation Plan approved by the Secretary of the Interior.

(2) A Technical Committee shall investigate the sludge deposits in Lake Champlain in and adjacent to Ticonderoga Bay to determine the location and concentration of mercury. Mr. Alfred Peloquin of the New England Interstate Water Pollution Control Commission shall be in charge of this Technical Committee and New York, Vermont and the Department of the Interior will provide members of the committee as well as available staff equipment and facilities required to carry out this investigation. The committee shall agree on the scope and conditions of the study and shall report its results to the conferees no later than July 24, 1970.

(3) The sludge deposits which have accumulated in Lake Champlain as a result of the aforesaid discharges constitute and will continue to constitute (even after closing of the existing International Paper Company facility) pollution of interstate waters subject to abatement under Section 10 of the Federal Water Pollution Control Act, as amended. These sludge deposits emanate from New York State. New York State shall report to the conferees, no later than August 21, 1970, its program including a time schedule to abate the interstate pollution caused by these sludge deposits.

That's it. The conferees, I guess, will be available to answer questions individually. With this, the conference is adjourned.

Copies will be made available for distribution.

(Whereupon, at 5:30 p.m. the conference adjourned.)

STATE OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK 12201

HENRY L. DIAMOND
Commissioner

July 17, 1970

Mr. Murray Stein, Chairman
Lake Champlain Enforcement Conference
c/o Federal Water Quality Administration
U. S. Department of the Interior
Washington, D.C. 20242

Dear Murray:

During the Lake Champlain Enforcement Conference on June 25, 1970, I stated that I thought that the New York State Health Commissioner's Order against International Paper Company at Ticonderoga, New York, had been modified in response to the request of the Company in the Fall of 1968. Later in checking our files, I found that the order was not modified. However, it has been and still is considered that compliance by the Company with its schedule providing for termination of discharges from pulping and bleaching operations by January 1, 1971, and for termination of discharges from paper-making operations by July 1, 1971, constitutes reasonable progress in abatement of the Company's pollution from the existing plant. Discontinuance of these discharges according to this schedule will be accomplished by transfer of the operations to the Company's new plant scheduled for start-up in December 1970. Water pollution abatement facilities which will insure compliance with water quality standards have been incorporated in the design of the new plant, the construction of which is now more than 80% complete.

I will appreciate your arranging to have this information included as footnotes to the transcript and the summary of the Conference so that the record will be corrected. I talked to Thad Rajda about this on the telephone on June 13, and he said he thought such a correction would be possible.

I am sorry for the delay in contacting you about this, but I was away on vacation for two weeks immediately following the Conference.

Sincerely,

Paul W. Eastman, P.E.
Assistant Commissioner

cc Mr. Metzler

U. S. GOVERNMENT PRINTING OFFICE : 1970 O - 408-941